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THE INFLUENCE OF COW'S MILK IN THE SPREAD OF DIPHTHERIA;

With an Account of a Milk Epidemic of Diphtheria.

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The general use of milk as an article of food, especially by the younger and least resistant portion of mankind, very much increases the importance of the question of its acting as a medium for the transmission of the germs of infectious diseases, and in the past decade much of interest has been added to our knowledge upon this subject. There is conclusive evidence that tuberculosis, typhoid fever, and cholera are not infrequently spread by means of milk. Other diseases, for which there is more or less strong evidence in this regard, are diphtheria, scarlet fever, erysipelas, measles, anthrax, and pleuro-pneumonia, and hydrophobia in cattle. (Peterson.[14])

Taylor,[21] in England, reported in 1870 an epidemic of scarlet fever which he thought was spread by milk. Here the first case was the child of a dairyman whose wife nursed the child and milked the cows. Since then Power, Klein, Cameron, Bostack, Hill, and others have studied extensive milk epidemics of scarlet fever.

Outside of England the only epidemic of scarlet fever has been traced to milk. (Johanessen.[7])

Escherich[3] calls attention to the fact that outside of England no milk epidemics of diphtheria have been reported.

Flügge,[4] in his recent exhaustive article on the epidemiology of diphtheria, concludes that diphtheria is never transmitted by means of food-stuffs, such as milk and meat.

The first published observation on the relation between milk and the spread of diphtheria was that of Power[16] in 1879. Power studied exhaustively an epidemic of diphtheria in the north of London, where, in an area one and a half miles in diameter, there occurred in the fifteen weeks between March 2d and June 15th, 264 cases of diphtheria in 116 households. Of these, 78 households showed their first attacks during the four weeks ending May 25th. The cases were most numerous in the central portion of the infected area, where in four weeks there occurred 175 cases in 70 households. Careful study of the water-supply and of the sewerage failed to explain the sudden outbreak.

Early in the epidemic Dr. Norton noticed that a large proportion of the infected houses had the same milk-supply, and further study of this showed that one man owned two dairies, one at Kilburn and one at Muswell Hill, some distance away. The milk from these two dairies was not mixed, though the cows were sometimes interchanged.

At the time of the epidemic the Kilburn dairy supplied daily 80 gallons, of which a constant supply was furnished A., of Kilburn (49 gallons), and B., of St. John's Wood (24 gallons). A. obtained the whole of his milk-supply from this dairy, but B. obtained a portion of his from other sources.

The milk dealer, X., also sold a variable quantity of milk to other retail dealers, two in Kilburn, five in Portland Tower, and one near Dorset Square. The milk from X.'s other dairy was sold daily by retail dealers. A study of the households in the most highly infected area showed that one-fifth of them obtained their milk from A. and B., dealers in X.'s milk. The incidence of diphtheria in households supplied with milk to the middle of June, when the epidemic ceased, showed: Of 236 households supplied by A., 37 invaded, or 15.6 per cent.; of 237 households supplied by B., 31 invaded, or 13 per cent. Average, 14.3 per cent. Of 2227 households supplied by other milkmen, 30 invaded, or 1.3 per cent., showing a difference of incidence in the proportion of 11 to 1 between the two sets of customers.

In the outer circle the incidence of throat illness between households supplied by A. and B. and those supplied by other milkmen was 12 to 1. The milk could not be credited with all the mischief, as there were cases of diphtheria in the neighborhood before, during, and after the severe outbreak, which were in no way connected with the milk-supply.

The nine gallons of X.'s milk sold in Muswell Hill were mixed with milk from other sources, but cases of diphtheria could be traced along its distribution. Power was not able to trace the contamination of the milk to a case of human diphtheria, careful inquiry failing to show any case from which the milk could have been infected.

The occurrence of the disease was especially well marked among children. Out of 233 cases whose ages were inquired into there were in

from 0 to 1 year 2 cases, or 0.8 per cent.; from 1 to 3 years, 21 cases, or 9 per cent.; from 3 to 12 years, 124 cases, or 53 per cent.; from 12 to 20 years, 31 cases, or 13 per cent.; over 20 years, 55 cases, or 23 per cent. So those using most milk were proportionately most severely affected.

Power,[18] in 1886, studied another epidemic of diphtheria apparently due to infected milk. During October, 1886, there was a sudden outbreak of diphtheria in York Town and Camberly, a country district with scattered houses, inhabited by well-to-do people, military, tradespeople, and cottagers, numbering in all about three thousand persons. Though diphtheria had prevailed for some years in parts of the same parish, this district had remained free. On October 13th more than a dozen cases were reported, and by the 24th there were seventy cases with thirteen deaths.

Early in the epidemic it was noticed that the infected houses received milk almost exclusively from one dairy. The cases were widely scattered and no other common source of infection could be discovered. Power made inquiries into the milk-supply of all the infected houses and into 82 non-infected houses. Of the 176 households studied, 57 were infected with diphtheria, 88 cases; and in addition to these there were 5 cases of scarlet fever and 47 cases of more or less grave throat illness. There were 16 deaths. Of the 57 houses and 147 people attacked (including cases of scarlet fever and the cases of throat illness not classed as diphtheria) 90 per cent. were affected between the 8th and the 18th of the month. Of the 176 houses 94 took the suspected milk. All the milk-receiving houses were in the infected district. The 82 non-milk-receiving houses studied by no means included all the houses not receiving milk. The 94 milk-receiving households had in October 48 houses with diphtheria, with 81 cases and 15 deaths. During the same period 9 of the 82 non-milk-receiving houses were infected, 6 cases reckoned as true diphtheria and 10 as minor throat illness, diphtheria or not, with only one death. So of the 176 households studied, 57 were attacked in October and 48 (84.2 per cent.) received milk from the suspected dairy—all becoming infected in ten days. Of the 140 persons with throat illness 124 (88.5 per cent.) were members of families using this milk, and 93.5 per cent. were attacked between the 8th and the 17th of October.

The milk consumers could be divided nearly equally into two distinct classes: (1) the better class; and (2) the cottagers and tradesfolk, who suffered very differently. Of 44 families of the first class 37, or 84 per cent., were invaded; of the 50 families of the second class 11, or 22 per cent., were invaded. Of 317 individuals of the first class 105, or 31 per cent., were attacked, 29 per cent. of the adults exposed being attacked and 54.1 per cent. of the children. Of 239 individuals of the second class only 6.3 per cent. were attacked.

Both classes received the same milk, the whole of the milk yield being thoroughly mixed before distribution. No skimmed milk was sold. The poorer class took less milk and used their milk at once after its receipt, usually in hot tea or coffee; while the richer class took larger quantities and often let the milk stand. Children in the poorer families received little milk, while in the well-to-do families they lived largely upon it, and many were large milk-drinkers.

Cream was not a factor in the spread of the disease, while skimmed milk was. In 11 houses where this was used (the milk standing some time to let the cream rise) there was a great incidence of diphtheria, both in children and in adults, heavier than in any other group of households of similar size. The amount of milk taken seemed to bear an important relation to the incidence of the disease and the severity of the attacks. Out of 217 adults, not special milk drinkers, in 41 households 27.6 per cent. were attacked; while of 32 adults in 21 households, where considerable quantities of milk were consumed, 78 per cent. were attacked. Of 10 children in 8 households reported as not taking milk only one was attacked, while of 33 other children taking largely of milk 70 per cent. had diphtheria. The disease was fatal for more than one-third of the children partaking largely of milk. Power was not able to trace the infection of the milk to a case of human diphtheria. He concluded that the milk was infected before leaving the farm, but it could not be discovered how.

The cows were examined and pronounced healthy October 13th. About November 1st one of the cows had "chapped teats."

Power,[19] in 1887, studied another severe outbreak of diphtheria apparently spread by milk. At Eading there was a sudden outbreak of diphtheria lasting seven days among the customers of a certain dairy, who suffered twenty times more severely than others not using this milk. All of the deaths occurred among persons using the suspected milk. No satisfactory explanation for the infection of the milk was found.

Clark[2] has reported an epidemic of diphtheria occurring at Melrose and Malden in June, July, and August, 1886, which he thought was directly traceable to the milk-supply, and 13 out of 16 infected foci receiving the suspected milk.

Mason[13] attributed the outbreak of diphtheria in Barking in 1888 to the milk of a particular dairy. Klein found an eruption on the teats of some of the cows of this dairy.

In 1890 Philpot[15] investigated an epidemic of diphtheria at Croyden. The outbreak was distributed along a particular milk-route. Of 541 houses receiving the suspected milk 65, or 12 per cent., had cases of diphtheria, while of the 1600 other houses 32, or 2 per cent., were infected.

The infection of the milk-supply could not be traced to a case of human diphtheria. The teats of some of the cows of the suspected dairy showed sores.

In American literature there are two instances in which spread of diphtheria has been attributed to milk. The first report is that of Goodwin,[16] of Assapolis, Mich., where a Mrs. D. had a severe attack of diphtheria. In each of two families in the same block receiving milk from Mrs. D.'s cows there appeared a case of diphtheria. Although there was no other mode of transmission of the virus found, this appears to be only a coincidence, and one would hesitate, without further evidence, to class this as milk infection.

W. H. Stillman,[20] of Kalamazoo, Mich., reports six cases of diphtheria occurring in two families using the same milk. In one family the mother and four children, and in the other, one adult had the disease. All the children and one adult used the milk freely. The cows seemed perfectly healthy.

On December 13, 1894, the writer was invited by Dr. W. T. Miller, of the Ohio State Board of Health, to accompany him to Ashtabula, Ohio, to study a sudden outbreak of diphtheria.

Ashtabula, a town of about twelve thousand inhabitants, situated on Lake Erie, is divided into two parts, the harbor and the town proper. The harbor is a large ore port, with a population of mixed nationalities numbering about three thousand persons, and lies directly upon the lake front. Many of the houses are small, crowded, and ill ventilated. The people are intimately associated through their work, churches, and the schools, and constantly neglect the rules of the sanitary authorities. Diphtheria, scarlatina, and typhoid fever are usually endemic there.

The drainage is mostly surface, and the water-supply is derived from the lake and from wells.

The harbor consists of the First and the Sixth Wards, and is separated from the town proper by the valley of the Ashtabula River.

The town proper, having about nine thousand people, is situated on rolling ground about two miles inland and on a somewhat higher plane than the harbor. It is divided into the Second, Third, Fourth, and Fifth Wards. The streets are wide, the houses well built, and often surrounded by large lots. The people in general are very well-to-do. The drainage is mostly surface, and a large part of it goes into the river. The water-supply is derived from the lake and from wells.

A large portion of the Second Ward is not built up, and the houses are few and widely scattered.

The bulk of the population live in the Third, Fourth, and Fifth Wards, and here the principal business and residence streets are situated.

At the harbor there were reported in the eleven months from January

1, 1894, to December 1, 1894, 87 cases of diphtheria, of which 57 were in the First and 30 were in the Sixth Ward. During the same period only 18 cases were reported in the town proper, 2 in the Second, 4 in the Third, 11 in the Fourth, and 1 in the Fifth Ward. A study of the occurrence of diphtheria by months during this period shows for January, 11; February, 24; March, 17; April, 5; May, 7; June, 3; July 2; August, 2; September, 2; October, 15; November, 17 cases.

For the spread of the disease at the harbor during this period there does not appear to be any special mode, and careful study fails to show any common source of infection beyond the habits of the people, which afford abundant explanation. The Local Health Officer has not been able in three years to trace any special relation between different houses and the occurrence of diphtheria at the harbor.

The population there is largely a floating one, and many of the resident families take in as boarders during the spring and summer months numbers of transient workmen. These people are not especially attacked by the acute infectious diseases, and during their stay diphtheria is at its lowest. Diphtheria is kept spreading among the permanent residents by their free intercourse and careless habits.

On December 5, 1894, there was a sudden outbreak of diphtheria in the town proper, where there had been no cases for some time. Between the 5th and the 13th there were reported 67 cases of diphtheria occurring in 49 houses. On the 6th there were 5 cases; on the 7th, 8 cases; on the 8th, 10 cases; on the 9th, 6 cases; on the 10th, 14 cases; on the 11th, 5 cases; on the 12th, 8 cases; and on the 13th, 7 cases. After this there was a marked decrease in the number of new cases. On the 14th there were 3 cases; on the 15th, 2 cases; on the 16th, 1 case; on the 17th, 4 cases; on the 18th, 5 cases; on the 19th, 2 cases; on the 20th, 2 cases; on the 21st, 3 cases; on the 22d no case; on the 23d, 2 cases; on the 24th no case; on the 25th, 1 case; on the 26th, 2 cases; on the 27th, 1 case; on the 28th and 29th no case; on the 30th, 3 cases; on the 31st, 2 cases; a total for the eighteen days of 33 cases.

It is probable that during the first few days of the outbreak there were a number of cases which did not come under the care of physicians and were not reported. Two such cases came later to my notice. They were both mothers who had what they called "cancrous sore-throat," and in each case I demonstrated the diphtheria bacillus in cultures made from their throats two weeks after recovery.

Diphtheria afterward broke out in the family of each.

Some of the cases reported on the 6th really occurred on the 4th and 5th.

The accompanying table gives the distribution of the cases reported between December 6th and 13th by wards:

	Number of cases.	Wards.						Number of houses.
		First.	Second.	Third.	Fourth.	Fifth.	Sixth.	
December 6 . .	5	0	0	0	3	1	1	5
" 7 . .	8	0	0	1	5	1	0	7
" 8 . .	10	0	1	1	7	0	0	9
" 9 . .	6	0	1	0	3	1	0	5
" 10 . .	15	0	2	1	4	0	0	7
" 11 . .	5	0	0	4	0	0	0	4
" 12 . .	8	0	2	3	1	0	0	6
" 13 . .	7	0	2	0	1	0	3	6
Total . .	64	0	8	10	24	3	4	49

So in nine days there was an incidence of 64 cases of diphtheria in 49 houses. All these houses were, as a rule, widely separated, and all but four (Sixth Ward) situated in wards previously entirely free from diphtheria. Of the 33 cases occurring from the 13th to the 31st of December 21 were in previously infected houses, and the remaining 12 in 7 houses were new invasions.

That the disease prevalent in Ashtabula was true diphtheria was proved by the finding of diphtheria bacilli in cultures made from a large number of the cases ill or convalescent between the time of my first visit, December 13, 1894, and January 13, 1895. During this time diphtheria bacilli were demonstrated in cultures made from the throats of 46 patients. Many of these were among the first cases attacked. At the time of my first visit 18 individuals had died of the disease. The cases examined by culture methods were not chosen especially for this purpose, but represented a fair average of the cases reported as diphtheria. My observations led me to the conclusion that all the cases reported as diphtheria during this time were true diphtheria, and that some mild cases had been overlooked, and that had routine bacteriological examinations been made earlier the number of reported cases of diphtheria would have been increased.

Of the 100 cases of diphtheria reported in December, 24 died. Previous to our arrival, Dr. A. W. Hopkins, the Health Officer of Ashtabula, was convinced that the milk-supply of the town had played an important rôle in the spread of the disease. As early as December 8th it was oberved that all the infected houses received milk from the same source, and that milk-drinkers were more often and more severely attacked than others.

Dr. Hopkins's investigations showed that the milk-supply of the town was derived from two dairy farms, situated at opposite sides and

about two miles from the town. For convenience these two milk-supplies will be styled X. and Y. The Y. dairy supplied about two-thirds of the houses taking milk. No case of diphtheria occurred in households taking X.'s milk, except in two instances. In these cases, though regular customers of X., the individuals on one occasion obtained each a quart of milk from Y., and both had diphtheria two days later. With these exceptions all the cases of diphtheria were in households regularly supplied with Y.'s milk, which was distributed by two wagons, a red and a white wagon. The white wagon supplied houses in the town proper (Second, Third, Fourth, and Fifth Wards), and the red wagon the harbor (First and Sixth Wards).

The cases of diphtheria were entirely confined to houses taking the Y. milk. On inquiry at the Y. dairy farm it was found that the family consisted of four, Mr. and Mrs. Y., both well advanced in life, and two sons, aged respectively about twenty-four and twenty-six years. No help lived on the farm, which was conducted by the men of the family with the aid of one or two hired men. The three older members of the family were and had been perfectly healthy; but the younger son, Henry, had been taken ill December 1st with a "bad cold," and on the 3d complained of sore-throat, and on the 4th, while still attending to his duties, milking and delivering milk, he felt ill and had general body pains, and his "sore-throat" was much worse. Henry drove the white milk wagon, and the red wagon was driven by a hired boy. On the 5th and 6th he still complained of sore-throat and was too ill to deliver milk. He did not go to bed, but was able to go to the cow-barn several times during these two days. With the sore-throat there was pain on swallowing. His throat was not examined, and he was not under the care of a physician. His place on the milk wagon for these two days was taken by a hired man. On the 7th and 8th he was well enough to deliver milk, but on the evening of the 8th he was stopped by order of Dr. Hopkins. Two days later the dairy was quarantined and the sale of its milk prohibited. On December 9th Dr. Hopkins carefully examined Henry's throat, and found "the fauces reddened and congested and the right tonsil considerably enlarged, with distinct enlargement of the right side of the neck." There was no false membrane present. Henry said that his neck had been considerably swollen during the height of the attack of "sore-throat."

On December 13th, with Dr. Miller and Dr. Hopkins, I examined the Y. dairy. The dairy was found to be well ordered and clean, and the cows were in good condition. We could discover no sores, ulcers, or swellings of any kind on the teats, udders, or any other parts of their bodies. Their noses were free from disease. I made several cultures of Loeffler's blood-serum mixture from Henry's throat and nose, and a number of cultures were made upon the same medium from some

milk that had been standing in the house for a day, from some of the morning's milking, from some newly-made butter, from several delivery milk-cans, from two milk-dippers, and from the bell used in Henry's milk wagon. These cultures were carried to my laboratory in Cleveland that night and put in an incubator at body temperature. In none of these cultures was the diphtheria bacillus found. In the cultures made from Henry's throat there grew the staphylococcus pyogenes aureus and albus, and a long bacillus in no way resembling the bacillus diphtheriæ.

On December 17th I again made cultures from Henry's throat and nose and from samples of the morning's milking and from the milk-cans. At the same time a careful examination was made of each cow, but no evidence of any disease of their noses, mouths, teats, or udders was found. All the dairy appointments were clean. The milk-cans and utensils were carefully washed in hot water, I was informed, immediately after use. Those seen by us were bright and clean and quite dry. I was again unable to find the bacillus diphtheriæ in the cultures made from the above sources.

On December 18th cultures were made from samples of milk from all the dairy wagons in the town and from the city water-supply and from the water of several wells. From none of these sources were diphtheria bacilli obtained.

It is to be observed that all the cultures were made from the milk and milk utensils at a time when Henry's nose and throat were proved free from the bacillus diphtheriæ.

I personally investigated 44 of the 49 houses from which cases of diphtheria were reported between the 5th and the 13th of December. At the beginning of the epidemic there were in these 44 houses 212 individuals, 140 adults and 72 children. Of these 212, 62 (of whom only 26, or 41.3 per cent., were under sixteen years of age) had diphtheria between the 5th and 13th. Forty-two of these 44 households were regular customers of the Y. dairy, and received milk exclusively from this source. The two remaining households, though not regular customers, obtained milk from this dairy at this time. Of the 212 individuals exposed 78 drank milk regularly and freely, 118 took milk only in tea or coffee, 6 used only cream, and in 10 cases no record could be obtained. While diphtheria was by no means confined to those drinking milk, the proportion of milk-drinkers affected was much greater than in individuals taking milk only in tea or coffee. The average amount of milk taken per household was 1.2 quarts. Thirty-two of the 44 households investigated obtained milk from the white wagon driven by Henry, the remaining 12 being served by the red wagon. The milk was delivered only in the morning after the breakfast of most of the customers, and the milk used in tea and coffee was usually kept several hours at least before using.

Of the 212 individuals in the 44 houses investigated 62, or about 27 per cent., were attacked as first cases, while of the 150 individuals escaping infection in the first outbreak of the disease 23, or about 15 per cent., contracted diphtheria later, as secondary infections. If the 10 individuals who did not use milk or cream are left out of consideration, the percentage of primary infections rises to 32 per cent. of those exposed. Altogether in the 49 houses there were 100 cases.

It was not possible to ascertain the exact number of houses supplied with milk from the Y. dairy. It is safe to say that they did not number more than 150, and in this case there was an incidence of diphtheria in about one-third of the houses exposed. A number of households had their own cows, and all these households were free from diphtheria.

So sudden and widespread an epidemic must have had a single focus of infection. Besides the milk there is to be considered the possibility of infection by means of the water-supply or the presence of one or more diphtheria-infected individuals at some public gathering. Investigation showed that only a small proportion of the infected houses had the same water-supply. A number of the infected households used water from their own wells.

On November 28th several men came to Ashtabula exhibiting a model of a Swiss village. This entertainment was patronized by a number of children from both the town and from the harbor. None of these men were ill, and a large number of the families having diphtheria did not attend this exhibition. When the entertainment moved to an adjoining town no cases of diphtheria occurred there.

On December 6th the opening of a new store was largely attended, especially by children, to whom presents were offered. Few adults attended either of these gatherings, and it is to be remembered that in this epidemic the special incidence of the disease was in adults, especially the first cases.

The individuals attacked belonged to several religious sects, and no connection could be traced between churches and schools and the spread of the disease.

Besides the above, there were no general gatherings of people. An investigation of the meat and other market supply as a possible source of infection was equally negative.

So by exclusion and by the strong circumstantial evidence brought forward it is almost conclusively demonstrated that the means of spread of the epidemic was the milk of the Y. dairy.

There are several ways in which milk may become infected with diphtheria bacilli.

It seems established by the experiments of Klein[10] that diphtheria bacilli inoculated into the shoulders of cows in a certain number of cases reach the udder and gain access to the milk.

According to Kanthack,[8] Klein has inoculated virulent diphtheria bacilli into ten cows, in all of which there was local reaction, and in six there were severe visceral lesions. Five of these cows developed upon the udder a vesicular eruption which could be communicated to calves, and in milk of two of these cows the bacillus diphtheriæ was found. In some cases the bacillus diphtheriæ was found in the vesicles appearing upon the udders.

Abbott[1] repeated Klein's experiments, using two cows. Neither animal developed the udder eruption described by Klein, and careful study failed to show the bacillus diphtheriæ in the milk.

Klein,[11] in November, 1890, observed with Philpot, at Croyden, ulcers on the teats of cows in a dairy along the milk-supply of which diphtheria had invaded a number of households. These ulcers Klein considered identical with those occurring on the udders of cows inoculated by him with the bacillus diphtheriæ, and regarded these as the source of infection. He does not state whether or not he demonstrated the bacillus diphtheriæ in the ulcers of the cows of the Croyden dairy. Philpot was unable to trace the infection of the milk to a case of human diphtheria.

In the cows of a dairy the milk-supply of which Turner, of Hertfordshire, suspected as being the source of infection for a diphtheria epidemic, Klein again found ulcers on the udders and teats.

Klein[12] seeks, on the observation of Power on the Herndon scarlet fever epidemic, and on his own studies on the udder affections of cows, to establish a direct etiological relation between diseases in the udder in cows and the infection of the human subject with scarlet fever and diphtheria.

Power[17] attributed the infection of the milk in his first milk epidemic of diphtheria to "garget," an inflammatory disease of cows' udders, which was present in some of the cows of the suspected dairy. In the study of an outbreak of diphtheria among the children of Princess Mary's House, it was found that some of the cows of the dairy supplying the institution had "garget." "Garget," or inflammatory mastitis of cows, is probably, like other suppurative affections, caused by a variety of micro-organisms.* There is no evidence that it is ever caused by the bacillus diphtheriæ. It is quite possible, however, that the infectious agent of the throat disease occurring in communities drinking the milk of cows with garget may be the streptococcus pyogenes, the organism so commonly found in the lesions of this disease of the udder.

* Streptococci have been found in the milk, pus, or tissues of the udders or the teats of cows with this affection by Kitt, Nocard and Mollereau, Adametz, Guillebeau, and others, and more recently by Stokes and Clement, of Baltimore. It seems probable that all these observers have been dealing with the streptococcus pyogenes. Guillebeau has also found bacilli identical with the bacillus of Freudenreich in the milk of cows with mastitis.

The passage of the streptococcus through the udder of the cow may very much enhance its virulence for man.

If these suppositions be correct the explanation of the etiology of some of the above described outbreaks of "diphtheria" is at hand.

Klein's conclusions were warmly opposed in the discussion by Crookshank, Ostertag, McFadyan, Hime, and others. It was suggested by several speakers that the lesions observed in cows' udders by Klein were those of cowpox.

It has been argued that the diphtheria of cattle and calves may be transmitted to man by means of milk. But it has been conclusively shown by Loeffler that the micro-organism of the diphtheria of cattle is quite distinct from the bacillus of human diphtheria.

While it has not been established that cows can have human diphtheria and can transmit the infectious agent by means of their milk to man, the contrary is not proved, and the whole subject must be held *sub judice*. Though it may be possible, it is quite unlikely, owing to the very small number of milk epidemics of diphtheria.

It is to be wondered at that milk is not oftener infected with diphtheria bacilli after it leaves the udder than does happen.

Flügge[5] explains the small part played by milk and meat in the spread of diphtheria by presence in these articles of saprophytes which inhibit the growth of the bacillus diphtheriæ.

Air infection of milk by the bacillus diphtheriæ probably never occurs, because the organism is killed by the desiccation that must take place before it can be blown from place to place by currents of air.

Our present knowledge on this subject points strongly to the supposition that at least the most frequent mode of infection of milk with the bacillus diphtheriæ is from the hands, bodies, or clothing of milkers, dairy attendants, and milk handlers, who either have diphtheria themselves or have been intimately associated with diphtheria patients.

When milk is handled by such individuals there are many opportunities for its infection both at the dairy and during its distribution to customers. At Ashtabula the milk was carried in the dairy wagons in 10-gallon cans from which it was retailed, and was dipped with long-handled iron dippers. These, when not in use, remained in the cans, and at every movement of the wagon their handles were washed in the splashing milk. It is evident that if Henry Y. had the bacillus diphtheriæ on his hands, derived from his mouth, there was abundant opportunity for their distribution through the milk.

In the Ashtabula epidemic absolute proof of the distribution of the bacillus diphtheriæ by means of milk is more nearly approached than in any epidemic previously described.

The only link lacking in the chain of evidence is the failure to demonstrate the bacillus diphtheriæ in the nose or throat of Henry Y.

The lack of positive evidence in this particular does not, in our opinion, militate very strongly against this explanation of the spread of the disease. The cultures were made at least five or six days after the subsidence of the throat symptoms and the probable disappearance of the false membrane. As is well known, the time for which the bacillus diphtheriæ remains in the throat after the disapparance of the false membrane is very variable.

In 752 cases of diphtheria examined by Park[22] the bacillus diphtheriæ had disappeared from the throat in three days after the disappearance of the false membrane in 325 cases, and in 201 cases it persisted for from five to seven days.

If Henry Y. did have diphtheria there are numerous ways by which he may have infected the whole milk yield of the Y. dairy. He assisted in milking, and after each milking the milk from all the cows was mixed before its distribution. The special incidence and severity of the cases of diphtheria along his milk route may be explained by the manner in which the milk was obtained from the cans—with the long dippers, the handles of which were constantly washed in the milk.

The results of the quarantine methods pursued are instructive. The usual rule of the Health Officer was that a diphtheria infected house should be quarantined for fifteen days after the disappearance of the false membrane in the last case in the house. After bacteriological examinations were instituted in these cases the duration of the quarantine was governed entirely by the results of these. As a consequence many cases were released after a much shorter period of quarantine than under the old rule, and, on the other hand, some cases were shown to have in their mouths large numbers of virulent bacilli diphtheriæ for some days after the prescribed time. Our experiences in this direction do not materially differ from those of other observers. In most cases the bacilli disappeared from the throat by the fifth or sixth day after the disappearance of the false membrane.

In conclusion, I desire to express my thanks to Dr. Miller, of the State Board of Health, to Dr. A. W. Hopkins, Health Officer of Ashtabula, and to other physicians of Ashtabula for many kindnesses and courtesies extended to me during these investigations.

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THE SURGICAL TREATMENT OF SUPPURATIVE PERICARDITIS.[1]

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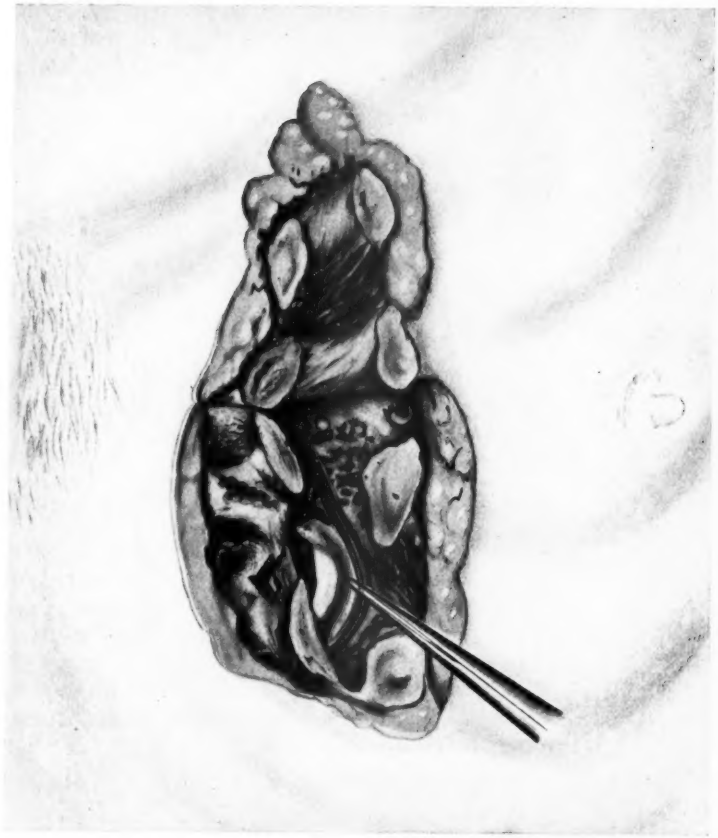
(A Contribution from the Surgical Laboratory of the Philadelphia Polyclinic.)

THE invitation to open the discussion on this topic has been accepted with pleasure, because I have long been interested in pericardial surgery. Studies made some twenty years ago convinced me that effusions in the pericardium should be treated by surgical measures similar to those adopted in pleural accumulations. At that time (1876) I suggested that purulent pericarditis be treated by the insertion of a drainage-tube into the pericardial cavity.[2] The proposal was thought by many to be rash and unworthy of surgical consideration.

Rosenstein, however, adopted this method of dealing with the disease in 1879, and saved his patient. He was followed by West, in 1882, with equally gratifying success. It has been supposed that these were the earliest recorded cases in which suppuration within the pericardium had been treated by incision and permanent drainage. Within a few weeks, however, I have found reported[3] the case of Hilsmann. (Case

[1] Read at the meeting of the American Surgical Association, May 4, 1897.
[2] New York Medical Journal, December, 1876. Idem, April, 1877, p. 384. Paracentesis of the Pericardium, Philadelphia, 1880, p. 55.
[3] Ueber die Paracentese des Pericardiums. F. A. Hilsmann, Kiel, 1875.



Author's Chondro-plastic Method of Pericardotomy, by a Trap-door Excision of Costal Cartilages, which avoids Injury to the Pleura and Internal Mammary Vessels.

[The flap, consisting of portions of the fourth and fifth cartilages and the attached soft parts, is turned upward, exposing the left lung covered with pleura and the internal mammary vessels. The forceps is seen holding the vessels and the edge of the pleural sac outward, so as to expose the white pericardium, in which an opening, indicated in black, has been made.]

No. 1 in table.) He operated in 1844 upon a man who had been sick about eight months, and evacuated several tumblerfuls of pus by an incision in the fourth intercostal space. The opening was kept patulous by the frequent insertion of a probe. The patient recovered. Langenbeck,[1] in 1850, treated with similar success a purulent pericarditis occurring subsequent to necrosis of the ribs due to gunshot-fracture. (Case No. 2 in table.)

I reached the conclusion in 1881[2] that pericardial incision and suture of cardiac wounds might be successfully accomplished, and should be undertaken. Dalton,[3] within recent years, successfully resected six inches of the fourth rib for stab-wound of the pericardium and sutured the pericardial sac with a continuous catgut suture.

Williams[4] successfully ligated wounded internal mammary vessels and stitched the pericardium in a patient who had been stabbed and received a wound of the heart-wall. He resected part of the fifth cartilage. The patient was well over three years later. Schnitzler[5] protected a torn pericardium with iodoform gauze when suturing was difficult. The pericardium has been torn and the heart exposed during the resection of the thoracic wall for chondroma, and recovery has followed. Rehn recently showed,[6] at a meeting of German surgeons, a man upon whom he had fourteen days previously sutured a stab-wound of the right ventricle after costal resection and enlargement of the pericardial wound. A stab-wound perforating the pericardium, going through the diaphragm and injuring the liver, was treated successfully by Bouffleur,[7] who opened the abdomen and sutured the diaphragm. Ferraresi[8] resected three costal cartilages in a wound of the mammary artery and heart, and used gauze, applied with moderate pressure, to restrain the bleeding from the heart-wall. The injury of the cardiac muscle was not deep. His patient recovered.

These reports prove that the pericardium and heart do not resent a properly conducted surgical attack, and render a discussion of the topic selected valuable.[9]

PERICARDOTOMY and provision for thorough drainage are always demanded by the presence of pus in the pericardial sac. The etiology of the purulent condition should have no influence in deciding the question of treatment.

[1] Vorlesungen über Akiurgie, Berlin, 1888, p. 449.
[2] Annals of Anatomy and Surgery, Dec., 1881, p. 250, and Medical News, January 13, 1883.
[3] Annals of Surgery, 1895, xxi. p. 147.
[4] New York Medical Record, March 27, 1897, p. 437.
[5] Rullier in Arch. de Méd. et de Pharm. Militaire, January, 1896, p. 110.
[6] Medical News, December 5, 1896.
[7] Chicago Clinical Review (1892–93), i. p. 30.
[8] Gazz. Med. di Roma, 1896, xxii. p. 29.
[9] Parrozzani has recently cured by suture of the heart a case of penetrating stab-wound of the left ventricle. Reported by Brock in Lancet, July 31, 1897, p. 260.

The suppurative pericarditis may be primary—a rare condition,—it may be secondary to serous or hemorrhagic pericarditis, to suppurative pleuritis or mediastinitis, to septic processes in distant regions, or to trauma; but the surgical indication is unvarying. Tubercular pericarditis, and pyopericardium, due to rupture into the pericardium of an abscess situated below the diaphragm[1] or elsewhere, require in the same way pericardotomy and removal of the puruloid or purulent accumulation.

The accessory treatment must be varied in accordance with accompanying general or local deviations from the physiological state. Rheumatism, scurvy, pneumonitis, pleuritis, tuberculosis, empyema, abscess, and pyæmia require efficient medicinal and surgical therapeusis. The remedial measures employed for these conditions must never, however, be allowed to interfere with the instant and complete rescue of the heart from the dangers incident to the presence of pus in the pericardial cavity.

Let the attendant administer antirheumatic, antiscorbutic, tonic, or other remedies, and aspirate, tap, or drain pleural sac or abscess-cavity; but these important measures must not delay the essential incision into the pericardium.

The improbability of pus becoming absorbed is great in all suppurative lesions; caseation or absorption of puriform material in tubercular conditions does not generally occur. It has been said[2] that small pleural empyemas may undergo spontaneous cure, but this is by no means to be expected. Modern surgery seldom suspends its activity when purulent or puruloid deposits in any region are to be treated Such deposits within the pericardium demand early evacuation even more imperatively. The mechanical effects of the hydrostatic pressure on the heart's action and the degenerative changes indirectly produced in the cardiac muscle must be averted.

The diagnosis of pericardial exudation is made by the physical signs and the symptoms. That the fluid in the pericardium is pus must usually be demonstrated by exploratory aspiration. When this confirmatory evidence has been obtained, pericardotomy is to be performed with as little delay as is commensurate with satisfactory operative facilities.

Thick pus, shreds of floating lymph or false membrane, or a needle of too small calibre may interfere with the demonstration expected by the use of aspiration. Under such circumstances the surgeon may be pardoned for delaying operative treatment a little while. A few days' time, not more, may be given to further study and therapeutic expec-

[1] See Varga's case, Gaceta Médica de México, 1887, xxii. p. 256.
[2] Parker, Trans. London Clinical Soc, 1889, xxii. p. 66.

tation; then an exploratory incision down to the pericardium must be made if the physical signs continue to suggest effusion.

Purulent pericarditis sometimes causes no fever and no local œdema. A dilated heart may present signs and symptoms so similar to pericarditis with effusion that inspection of the heart or its surrounding sac may be the only means of ascertaining the truth. I recommended diagnostic incision in such obscure cases as long ago as 1881,[1] and have seen no reason to change my opinion as to its value and desirability. If there is a probability, therefore, that the patient's urgent symptoms are due to either pericardial effusion or cardiac dilatation, and competent medical examiners cannot determine the exact lesion, exploratory incision is to be adopted. If this establishes the fact of effusion, puncture of the exposed pericardium will prove or disprove the existence of pus or serum. If pus be found, an incision should be made and permanent drainage established by stitching the pericardium to the skin or inserting tubular or gauze drains. Should the effusion prove to be serous, the puncture may be utilized to evacuate the entire quantity of effusion, and drainage may be omitted. The fluoroscope and skiagraphs will sometimes aid in diagnosis of obscure cases, but the apparatus is not always obtainable.

There is little dissent from the opinion that purulent accumulations in all regions require surgical intervention, lest the patient die of septic sequences or the pus be evacuated into neighboring cavities before nature can provide for its spontaneous exit. The supposed vulnerability of the heart long prevented the application of this principle of treatment to the pericardium. As a consequence, patients died with several pints of pus in the pericardium,[2] and autopsies sometimes revealed a burrowing sinus, reaching nearly to the surface; proving that the imprisoned pus was vigorously endeavoring to escape, that life might be saved.

Numerous recorded cases show the inutility in purulent cases of tapping, even if repeated. Gooch[3] tapped a case six times and injected iodine solution. The patient died in thirty-eight days. The survival for such a long period suggests that the boy might have been saved if the purulent fluid had been evacuated by incision at the first operation. In a case reported by Doubleday[4] seventeen pints of pus were withdrawn from the pericardium by ten aspirations in the course of thirty-four days; then death occurred. In Villeneuve's case[5] recovery subsequent

[1] Annals of Anatomy and Surgery, December, 1881, p. 250.

[2] In the New York Medical Record, March 9, 1895, p. 314, is recorded a case in which 2600 c.c. of pus and lymph were found at autopsy. See also Brit. Med. Journal, December 1, 1888, p. 1219; Gaz. Hebdom. de Méd. et de Chir., January 12, 1883, p. 25, and Brit. Med. Journal, 1885, i. p. 1246.

[3] Brit. Med. Journal, June 19, 1875.

[4] New York Med. Journal, September 1, 1888, p. 232.

[5] London Med. Rec., September 15, 1875, p. 532.

to pericardicentesis occurred after the persistence of a fistule at the seat of operation for nearly six months. The effusion was originally serous, but became purulent.

Death occurring after tapping has revealed great quantities of pus still in the pericardial sac, though large amounts had previously been removed. Smith found[1] thirty-six fluidounces at autopsy, though thirty fluidounces of pus had been withdrawn by aspiration. In some cases the original accumulation had been incompletely withdrawn; in others more pus had formed and had been denied escape because no permanent opening had been provided. In an autopsy made by Parker, in a case not operated upon, the distended pericardium reached to the anterior vertical axillary line on both sides and "sat like a saddle upon the lungs."[2]

Such observations show that aspiration and puncture afford only temporary relief in suppurative pericarditis, and that a free exit for the pus must be maintained for a varying length of time, until the internal surfaces of the cavity become modified or mutually adherent. The entrance of air into the pericardium during this time does no harm.

DRAINAGE of the pus may be maintained by stitching the incised pericardium to the edges of the cutaneous wound, by the insertion of drainage-tubes, or by the introduction of a gauze wick, which must be frequently renewed. Stitching the pericardium to the edges of the wound has the advantage of possibly preventing pus leaking into the pleural sac, if it has been opened by the surgeon during the pericardotomy. The method of operating which I recommend avoids this contingency. If, however, the pleura is cut, suture of pericardium to the skin is a judicous procedure when it can be done, for there is little doubt that secondary pleuritis, due to infection from leakage of the pericardial pus, is a real danger. Delorme and Mignon report[3] a case of suppurative pericarditis which died after tapping with a trocar in the fifth interspace 6 cm. to left of the sternal border. Pleuritis occurred suddenly after the pericardial tapping. Autopsy showed that the pleura had been wounded, and the pus in the pleural sac had similar bacteriological characteristics to that in the pericardium.

If the pleura is known not to have been punctured, drainage by a large but short rubber tube is probably the best method. It does not need renewal as does the gauze wick, and can be utilized for irrigation if the surgeon decides to use irrigation. Two short drainage-tubes, placed side by side, like the barrels of a double-barrel shotgun, are the most satisfactory in cases where irrigation is to be employed. The cleansing or antiseptic fluid is then allowed to flow in through one

[1] New York Med. Rec., February 12, 1876, p. 110.
[2] Trans. Clinical Soc., London, 1889, xxii., p. 63.
[3] Revue de Chirurgie, 1895, xv. p. 1016.

tube and out through the other, as in washing out the bladder by a two-way catheter. The catastrophe which happened in Parker's case (No. 14 in the table) would not then be likely to occur. His patient apparently died from pressure on the heart made by the irrigating fluid failing to escape from the pericardial sac.

THE PROGNOSIS after incision and drainage is good, provided the operation is done early and no serious complications have preceded or followed the surgical treatment. West saw his first case nine years later in good health, and Davidson's case had no cardiac or pulmonary symptoms when seen nine months after operation. Many of the cases of death recorded in the subjoined table are attributable to pyæmic infection, of which the pyopericardium was a mere incident. The relief due to the evacuation of the pus was great, but naturally it alone could not restore the patient to health, and he died of his general disease. In some cases death would probably have been averted if the pericardial condition had been promptly and efficiently treated. Delay causes myocarditis, cardiac debility, and exhaustion of the patient in secondary suppurative pericarditis; and in primary suppuration within the pericardium gives opportunity for general septic infection in addition to these risks.

The combination of pleuritis and pericarditis is quite frequent. It is probable that either may be the primary condition, leading to the other as a secondary inflammation by contiguity of structure or continuity of vascular connection. The histories in the table seem to show that, in some instances at least, the pleuritis has been caused by the surgeon's pericardial puncture or incision being made through the pleural sac, and thereby permitting its direct infection from the pus in the pericardium. This can be avoided in nearly every case by a properly planned operative attack.

The prognosis is sure to be bad in cases where delay has permitted enormous quantities of pus to distend the long-suffering pericardial sac, the patient's strength to be exhausted, his kidneys congested, the cardiac muscle degenerated, and perhaps the pericardial pus evacuated by ulceration into the bronchial tubes.[1]

The results obtained by incision and drainage in tubercular peritonitis suggest that drainage in tubercular pericarditis may lead to a permanent cure. The ease with which the pericardium can be irrigated with solutions of iodoform would seemingly add to this probability of success.

RESULTS. In the table of thirty-five cases of suppurative pericarditis of all kinds treated by incision fifteen recovered and twenty died. This gives a ratio of recovery of nearly 43 per cent. Of the fatal cases

[1] Allende's case. Revista de la Sociedad Medica Argentina, 1895, iv. p. 20.

ten at least were evidently septic before operation. Excluding those known to be septic, only ten died out of the thirty-five cases. Of these ten there are complications, such as purulent pleuritis, or pleural, pulmonary, renal, or cardiac lesions mentioned in every instance except one, in which no statement is made (Case 28). Such a showing is very satisfactory when it is known that without operation practically all cases die, and that with repeated aspiration nearly every case reported has terminated fatally. The experience of Fiedler[1] and others shows that this statement is true.

In a few cases, as in that of Villeneuve,[2] aspiration has been followed by recovery because nature established drainage by the formation of a fistule. Doubleday[3] states that Wyss reports a case of pyopericarditis in which a fistule formed spontaneously and lasted for years. Death finally occurred from an attack of acute pericarditis. In Newman's case (No. 9 of table) aspiration was repeatedly performed; but after a month of this palliative treatment drainage and subsequently incision were adopted. When death occurred, a few days later, it was discovered that nature had been endeavoring to supplement the surgical treatment by establishing in the second interspace a fistule from the pericardium to the surface. The canal had reached the subcutaneous tissue, but had not yet perforated the skin. This case shows nature's contempt for anything less than complete evacuation of purulent effusions, and is an indication that the proper surgical treatment in suppurative pericarditis is incision and drainage.

It is true that Douglas[4] reported a case of pus in the pericardium, treated by simple aspiration, that had not died up to the time of the report. The report, however, was made only thirty days after operation, and then the patient was expectorating purulent matter, due possibly to a communication between the pyopericardium and bronchial tubes. This case, therefore, affords no argument in favor of delaying incision and drainage. Langenbeck mentions[5] a case which was cured after the use of the trocar, but he gives no details. The trocar may have been so used as to permit permanent drainage.

Incision has also the advantage of reducing to a minimum the danger of wounding the heart. This organ has been punctured on a number of occasions in attempts to tap a distended pericardium with a trocar or an aspirating needle. Sometimes this has occurred from a mistaken diagnosis. It may also happen, however, because the heart has become adherent to the anterior wall of the pericardium. Even with such

[1] Sammlung Klinischer Vorträge, innere Medicin, 1881, No. 72.
[2] London Medical Record, September 15, 1875, p. 532.
[3] New York Medical Journal, September 1, 1888, p. 232.
[4] Trans Detroit Medical and Library Association, January, 1879, and Paracentesis of the Pericardium. John B. Roberts, Philadelphia, 1880, p. 93.
[5] Vorlesungen über Akiurgie, Berlin, 1888, p. 450.

adhesion a large and dangerously oppressive effusion may exist behind and at the sides of the heart. Diagnosis may then be difficult, because the heart-sounds will not be muffled.

Barlow reports[1] experimental punctures made after death on two cases of pericardial effusion. All the punctures made to the left of the sternum resulted in the aspirating needle entering the heart-wall and obtaining no fluid; but punctures made at the right side of the sternum reached the effusion without cardiac injury. The distinctness of the heart-sounds during life induced him to hesitate in adopting pericardicentesis, for the diagnosis was not certain. If he had aspirated in the usually accepted locations, he would have injured the heart and would have obtained no fluid; if, however, he had adopted incision as recommended in this paper, the diagnosis would have been cleared up, the fluid found, and the lives of the patients possibly saved.

Money relates[2] a very remarkable case where at autopsy twenty-four fluidounces of pus were found in the pericardium, "almost entirely stowed away behind the heart." The amount was not appreciated, even when the chest was opened, until the heart was moved. I and others have invented peculiar aspirating needles to avoid wounding the heart, when the effusion has been nearly all evacuated; but these devices will not avert puncture of an adherent heart or evacuate serum or pus confined behind the heart by intrapericardial adhesions.

Delorme and Mignon found[3] in one of their dissections a vein of such size lying on the front of the pericardium that a free hemorrhage would have resulted from its puncture. Such a complication is avoided by operating by an incision, which also prevents injury to the internal mammary veins and artery, should they be unusually located.

These observations and other reported cases not here mentioned have almost convinced me that incision is better than aspiration even in cases not supposed to be purulent. It establishes diagnosis in dubious cases, avoids cardiac injury, saves the pleura from puncture, affords complete evacuation of effusion, permits extraction of thick pus and membranous lymph, and gives opportunity for disinfection of the sac when that is necessary. Rullier[4] found it necessary to finally incise and drain a serous pericarditis which he had previously aspirated four times, even following the aspiration on two occasions with injection of tincture of iodine. The incision was done under local anæsthesia with cocaine. The patient recovered.

IRRIGATION has been adopted as an adjunct to incision in a number of cases. No immediate harm has seemed to result except in Parker's

[1] British Medical Journal, December 1, 1888, p. 1220. See also Churton, Trans. Clinical Soc of London, xxv. p. 43.

[2] Lancet, October 18, 1890, p. 818.

[3] Revue de Chirurgie, 1895, p. 829.

[4] Arch. de Méd. et de Chirurgie Militaire, January, 1896, p. 7.

case (No. 14); the child in that instance died during the irrigation, immediately after the incision, apparently from pressure on the heart exerted by the irrigating fluid. Irrigation was used to encourage the evacuation of the thick pus, which did not flow well; but the water did not escape on account of the pericardial opening becoming plugged with thick pus or membranous lymph. The child was pyæmic, and the heart, which was very weak, stopped beating.

It is certainly essential that the outflow of fluid be unimpeded when irrigation is employed. The fact that plugging, sufficient to prevent the escape of the irrigating fluid, occurred in this case would seem to indicate that something more than an incision was needed to empty the pericardium of the fibro-purulent material clogging the heart's action. Parker believes that he would have done better if he had given the heart a little time to recover strength after the first gush of pus before endeavoring to clear out the sac by irrigation. This would probably have been judicious.

The opinion of Sievers[1] that irrigation tends to produce adhesions and may delay convalescence is difficult to accept. The occurrence of intrapericardial adhesions to a greater or less extent would seem usually probable in suppurative pericarditis treated by evacuation; but case No. 18 seems to indicate that they need not occur.

More than one autopsy, made a long time after recovery from pericardicentesis, in non-suppurative cases, has shown the presence of adhesions. These were formerly thought to be the essential of cure. Pepper's case[2] showed complete adhesion fifteen months after aspiration.

Irrigation carefully performed with warm fluid gradually admitted to the pericardium, and given free vent by using two parallel drainage-tubes in the wound, ought to be beneficial in ridding the cavity of shreds of lymph and pus, and may perhaps modify the walls of the sac. I should prefer sterile salt solution at about 100° or 105° F., and would use it in cases in which there was much lymph mixed with the pus. If the heart is very weak, it may be wise to wait for a few hours after the pericardotomy. Daily repetition of the irrigation seems desirable if the drainage instituted does not keep the sac empty.

Weak antiseptic solutions are unobjectionable for irrigation, but probably unnecessary. It has been suggested that the reflex irritability of the heart is modified by the false membranes, and that consequently irritants applied by irrigation cause little cardiac disturbance.

I would not inject solution of hydrogen dioxide into the sac, lest the effervescence within the cavity cause injurious cardiac pressure.

The direct extraction of shreds and membranous sheets by fingers and

[1] Zeitsch. für klin. Med., 1893, xxiii. p. 45.

[2] Paracentesis of the Pericardium, John B. Roberts, Philadelphia, 1880, p. 79, and New York Medical Journal, December, 1876.

forceps is certainly judicious, when they can be seen or felt. Exploration of the interior of the pericardium with the finger and palpation of the heart itself are not objectionable under appropriate circumstances.

If the pyopericardium is one in which the pus is free from lymph and flows freely, irrigation may be unnecessary.

THE SITUATION at which the pericardium should be opened by simple tapping and by open incision deserves careful attention. In a former study[1] I reached the conclusion that the best two points for pericardicentesis were close to the base of the ensiform cartilage, in the fossa between it and the seventh left costal cartilage and the fifth left intercostal space, at from 5 to 6 cm. (2 to 2½ inches) to the left of the median line of the sternum. Of these two points preference was given to the latter for aspiration, even though its selection rendered perforation of the pleural cavity almost certain; but the importance of avoiding pleural injury in cases treated with a drainage-tube was recognized.

The puncture near the ensiform cartilage was regarded as an efficient route to the pericardium and one pretty sure to make the needle enter the pericardium without wounding either pleural sac. The chief risk in this location, perhaps, is that the diaphragm may be punctured if pericardial effusion is not present or if the surgeon does not direct the needle a little upward as he perforates the thoracic wall. Rotch's point in the fifth interspace, at 4½ to 5 cm. to the right of the edge of the sternum, is objectionable because it opens the right pleura.

The danger of infecting the left pleural cavity by the pus within a pyopericardium, when the pericardium is punctured or incised in a location which causes a penetrating wound of the pleural sac, is not a theoretical one. This is shown by cases in which serous or suppurative pleuritis has arisen, after pericardicentesis or pericardiotomy in the usually selected locations known to open the pleura.[2] While it is true that pleuritis may occur as the primary condition and pericarditis as the secondary lesion, or that both may arise from the same cause, clinical and bacteriological experience seems to show that direct infection from the pericardium to the pleura is a real danger. It is probably much less real, to be sure, in cases of hydropericardium or serous pericarditis than in suppurative pericarditis, since the effusion is apt to be less infective in character.

Ferrand[3] believes the point of election for tapping the pericardium to be in the fifth intercostal space, in a line vertically below the nipple, when the effusion is moderate; in the sixth intercostal space, on the

[1] Paracentesis of the Pericardium, Philadelphia, 1880, pp. 65 and 67.

[2] British Medical Journal, December 1, 1888, p. 1220; North American Journal of Homœopathy, New York, June, 1889, p. 392; see cases Nos. 3, 32, and 34 in table; Ashby's case of pericardial tapping through lung from scapular angle is interesting; Lancet, March 29, 1884, p. 560.

[3] Contribution a l'Etude de la Paracentèse du Péricarde, Bordeaux, 1893, p. 45.

same vertical line, if the signs denote a large effusion. He arrived at these conclusions by studying the limits of the pericardium and the downward displacement of the diaphragm after experimental introduction of fluid. He found that the arch of the diaphragm was lowered about 2 cm. in the recumbent position when 600 grammes of fluid were introduced, and that the depression was 3 cm. when the cadaver was put in a sitting posture. With 1100 grammes of plaster solution in the sac the cardiac apex at the left angle of the pericardium was at least 6 cm. from the thoracic wall. Delorme and Mignon found[1] the pericardium to be from 3 cm. to 5 cm. from the surface of the skin in cadavers.

Ferrand's points would puncture the pleural sac, and are, therefore, as unsatisfactory as that recommended by me in the fifth interspace.

Numerous dissections made by Delorme and Mignon show[2] that the edge of the left pleura is very variable in its relation to the left border of the sternum, and that the accepted points of puncture on the left side must often wound the pleura. This observation holds good for infants as well as adults. Puncture in the fifth and sixth interspace close to the sternum will not assure safety to the pleura, though it was formerly thought that here the pleura was out of harm's way.

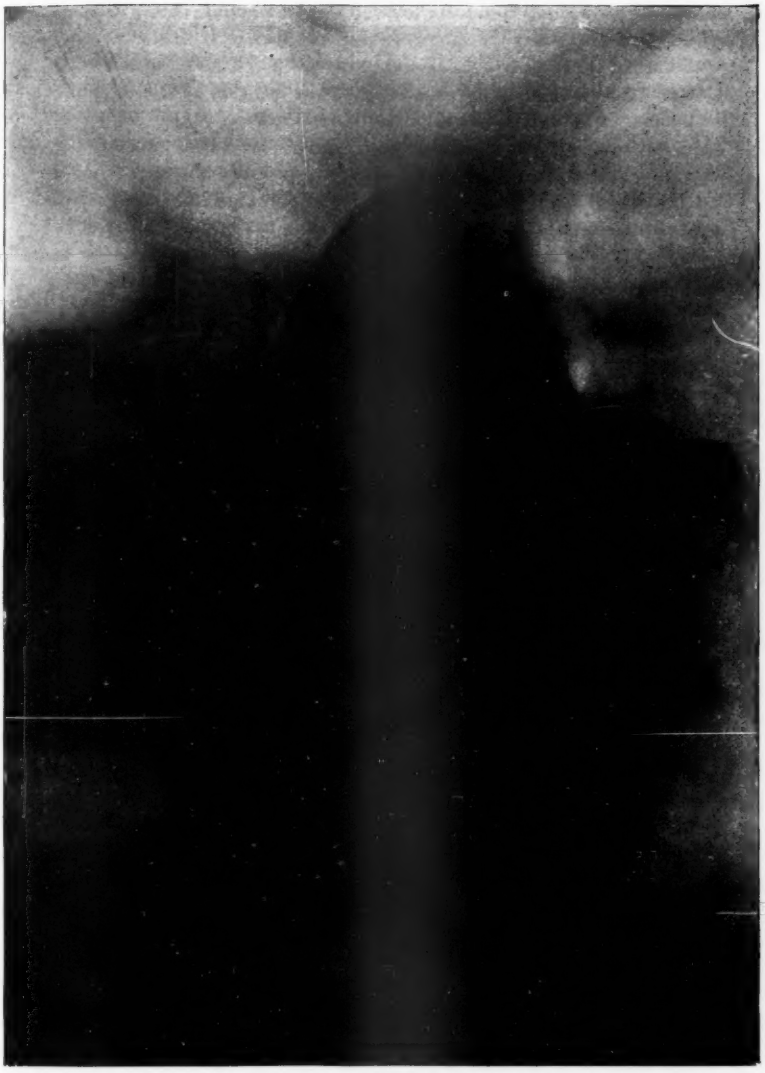
That pathological lesions change the pleural relations to the pericardium very little was apparently proved by their dissection of cases of pericarditis and by injecting fluid into the pericardium. This is not surprising when it is recollected that the parietal pleura is fixed to the thoracic wall.

The statement made by Fowler[3] that the boundaries of the pleura are greatly displaced in pericardial distention is, I believe, erroneous. The lungs are usually displaced, and may be thrust far backward by the distended pericardium sitting upon them like a saddle; but the pleuræ seem to hold their usual relations to the anterior wall. Of course, the two layers may in some cases become adherent by a local pleuritis, and thus lead to local obliteration of the pleural cavity.

My dissections lead me to believe that Delorme and Mignon are correct in stating that the pleura is in great danger of injury from the punctures usually made. The left pleura in many dissections made by these writers was out of the way, however, of a puncture made in the left xiphoid fossa.

These considerations lead me to the conclusion that, in cases of suspected suppurative pericarditis, the exploratory aspiration to determine with certainty the existence of pus in the pericardium should be performed in the upper part of the left xiphoid fossa. The needle should

[1] Revue de Chirurgie, December, 1895, p. 880.
[2] Ibid., December, 1895, and January, 1896.
[3] Trans. American Surgical Association, 1896, xiv. p. 161.



Skiagraph of a cadaver, in the pericardium of which about 740 c.c. of plaster-of-Paris solution had been injected. Tacks were thrust into the chest at the points recommended for aspiration by Rotch, Ferrand, and Roberts. The nipples are marked by the buttons.

be thrust upward a little and toward the median line of the sternum. In fat patients a small cutaneous incision should be made if it is difficult to locate with certainty the top of the xiphoid fossa. If this establishes the diagnosis, the pericardium should be incised and drained by resection of the fourth and fifth costal cartilages on the left side of the sternum, in the manner devised by me and described hereafter.

It is probable that even in non-suppurative pericardial effusions the left xiphoid fossa is the place of election for aspiratory puncture; but it does not afford room for incision and drainage. Hence in suppurative cases costal resection is to be adopted, because the pleura can then be readily pushed aside; the internal mammary artery, which may be as large as the radial, preserved from injury; and the surgeon have room for extraction of membranes or clots, or for any intrapericardial manipulation demanding fingers or forceps.

More than one instance is recorded where an incision or puncture evacuated the pericardial effusion found to exist into or through the left pleural cavity. In some cases the operation was performed for a supposed pleural effusion; but a distended pericardium was found to exist, and was then tapped through the original wound. The cases of West (No. 6), Savory (No. 7), and Gussenbauer (No. 11) are illustrations of this error of diagnosis.

West speaks[1] of a purulent pleuritis in which the needle, after being thrust into the pleural sac and obtaining pus, failed to perforate the pericardium. The pericardial symptoms diminished, and he believed that the pericardium had been nicked and had then drained into the pleura.

Resection of the thoracic wall for obtaining access to the pericardium has been proposed or done by Ollier, Durand,[2] Delorme and Mignon,[3] and Williams.[4] Durand's operation is a modification of that recommended by Ollier, and consists of the following steps:

"A cutaneous incision on the fifth costal cartilage, parallel to it and from 6 to 8 cm. in length. It should commence at the middle line.

"Isolation and rapid denudation of the cartilage with the aid of the bistoury.

"Resection of this cartilage, which should be commenced by separating it from its sternal attachments and raising it from within outward.

"To these fundamental manœuvres is added ligature of the internal mammary vessels at the upper and lower borders of the wound. These organs are thus put out of danger of secondary ulceration or of acci-

[1] British Medical Journal, December 1, 1888, p. 1220.
[2] Revue de Chirurgie, 1896, No. 6.
[3] Ibid., December, 1895, and January, 1896.
[4] New York Medical Record, March 27, 1897, p. 437.

dental perforation during the operation. The fingers then detach the triangularis sterni, the operative importance of which Delorme and Mignon have clearly shown. The fingers are then carried toward the middle line *under the sternum* and recognize the pleura. The distended pericardium is then seen. Displacement of the pleural sac is then attempted, the situation of which sac scarcely appears to be changed by the pericardial distention."

At this moment, if the displacement of the pleura is insufficient, or if the pericardium is hidden behind the sternum, the border of the sternum is cut away.

"Incision of the pericardium, which is widely accessible to sight and touch."

After some little work on the cadaver I propose the following operation for pericardotomy: The details are, I believe, in some respects new, though the writers just mentioned have suggested simpler methods. After I had proved to my satisfaction the efficiency of the method on the dead subject, and its reliability in avoiding pleural wound, I was gratified to find that much the same method of opening the thorax had been used by Williams[1] in a case of stab-wound requiring pericardial suture, which had healed favorably. His operation was not devised to prevent pleural injury, but to get access to a wounded internal mammary artery. I had supposed my method entirely novel until I recently saw his paper.

My dead-house investigations and his experience on the living patient supplement each other in a way that convinces me of the admirable character of the operative procedure which I advocate.

The operation consists in making a sort of trap-door, consisting of portions of the fourth and fifth costal cartilages, which is turned upward by utilizing for a hinge the soft tissues in the third intercostal space. A vertical incision is made about 1 cm. to the left of the median line of the sternum, beginning on a level with the top of the fourth costal cartilage. This cut is carried through the skin and subcutaneous tissue to the sternum, and is continued downward to a point corresponding with the level of the upper border of the sixth cartilage. The length of this incision is from 4 to 5 cm.

A second incision is made parallel to the first, beginning at the upper border of the fourth rib, at from 4 to 5 cm. to the left of the commencement of the first incision. It is continued downward from the top of the fourth cartilage to the upper border of the sixth cartilage. The curve of the sixth cartilage requires this incision to extend downward a little further than the first vertical incision; but as the fourth rib also is a little concave upward, the second cut is nearly of the same length as the first. The second incision is made deep enough to divide all the

[1] Loc. cit.

tissues down to the cartilages. The lower ends of these two incisions are joined by a third cut carried along the upper border of the sixth costal cartilage.

The soft tissues to the left[1] of the first incision are separated from the sternum and pushed outward, so as to disclose the exact situation of the articulation of the fourth and fifth costal cartilages with the sternum. With a large scalpel, having a thick back, the fourth and fifth cartilages are divided as near as possible to the sternal border in such a way as to leave a bevelled surface of the cartilage attached to the sternum looking forward and outward. This section of the cartilages may be made with a Hey's saw, if the surgeon prefers. A thick-backed scalpel, with a cutting edge having a large belly, will be found a satisfactory and safe instrument with which to divide the cartilages with the least danger to the tissues in the mediastinum.

The next step consists in dividing the cartilages immediately under the outer edge of the flap in a similar manner, leaving a bevelled surface to the portion left attached to the rib, which looks forward and inward toward the median line. The incision is near the junction of the ribs with the cartilages. Care must be observed to make the incision through the cartilage of the fifth rib vertically under the incision in the cartilage above. The tendency is to bring the incision inward toward the median line of the body, so that the opening made in the chest-wall becomes too narrow at the bottom of the flap.

In dividing the cartilages the operator must be cautious not to puncture the pleura, which is closely attached to the inner surface of the costal cartilages at the outer margin of the flap. There is less danger in making the costal incisions near the sternum, because in that region the muscular fibres of the triangularis muscle are immediately beneath the cartilages. The surgeon, having divided the cartilages completely, next cuts the intercostal muscles and soft tissues in the fifth, fourth, and intercostal spaces and along the upper border of the sixth cartilage.

The chondro-plastic flap is then carefully raised from its lower border and the tissues of the mediastinum are cautiously separated from the internal surface of the resected cartilages and the intercostal muscles. The trap-door is thus opened on the hinge at the upper border and the triangularis muscle exposed. Upon it, about 1 cm. from the border of the sternum, is seen the internal mammary artery and its two accompanying veins running parallel to the sternal edge. At the outer portion of the window the muscular fibres and fascia are thinner and cover the lung and pleura. An incision is made through the triangularis muscle, close to the sternum and therefore within the line of the

[1] "Left" means the patient's left.

internal mammary vessels; and is carried up and down as far as the opening in the chest-wall will permit.

With the finger or a curved blunt instrument the surgeon then separates the fascia and muscular fibres and pushes the outer part with the vessels and the double edge of the pleural sac outward toward the external border of the opening. The shining white surface of the pericardium is then seen lying behind the sternum and along the inner portion of the opening. The pleura, which often has considerable fat along its edge, like the appendages of the colon, may not be seen, because it is pushed out of the way without having the overlying fatty tissue separated from it. If it is seen, its transparency or pinkish color will distinguish it from the white and more opaque pericardium.

Injury to the vessels or pleura is thus averted during the pericardotomy, because they are pushed away from the proposed opening into the pericardium. The pericardial sac is incised vertically or obliquely between the sternal border and the displaced vessels and pleura and a drainage-tube inserted. The length of the incision into the pericardium should be sufficient to permit extraction of membranes and thick pus. The surgeon's finger may be introduced for exploration.

If irrigation is employed, it is best to use two tubes, one to admit the fluid, the other to give it free exit. The drainage-tubes are introduced and brought to the surface through the fifth intercostal space, after trimming away the lower portion of the flap; and the chondro-plastic flap laid in position. If it is preferred, the tubes may be brought out through holes made in the flap between the fourth and fifth cartilages. The bevelled cartilages fit accurately together, and the flap will show little tendency to drop inward, even if the lungs and pericardium fail to support it. The cartilages may be sutured with catgut by passing the needle through their substance. In cutting the cartilages obliquely during the early part of the operation it is desirable not to bevel them too much, because the internal edges then project so far that it is difficult to get under the sternum. The bevelled surface should make an angle of about 45° with the internal surface of the cartilage.

It may be objected that this method of resecting the thoracic cage does not open the pericardium at its very bottom. It might be suggested to resect the fifth and sixth cartilages instead of the fourth and fifth. I prefer not to do this, because there is considerable danger of opening the abdomen when separating the outer end of the sixth cartilage from the underlying tissues. This danger would be less, of course, if a pericardial effusion had pushed the diaphragm downward. The manner in which the outer portion of the costal cartilage of the sixth rib runs obliquely downward renders the danger more imminent than might be supposed. Another objection to resecting the sixth cartilage is the common presence of a cartilaginous bridge between

No.	Operator and date.	Sex and age.	Duration of illness.	Complication.	Tapped previously.	Situation of incision.	Quantity of pus evacuated.	Irrigation.
1	Hilsmann, 1844	M. 25	8 mos.	None.	No.	4th interspace, a finger's breadth from left edge of sternum.	About 1 quart; much more escaped within a few hours after operation.	No.
2	Langenbeck, 1850	Not given	Not given.	Gunshot wound and necrosis of ribs.	No.	Where 5th rib was absent.	Not given.	No.
3	Rosenstein, 1879	M. 10	28 days	Pleuritis.	Twice a few days previous with aspirator; pleura also tapped.	4th interspace near sternum.	Great quantity.	No.
4	West, 1882	M. 16	1 mo.	None.	Yes, three days previously.	5th interspace in line of left nipple.	2 quarts.	Carbolic acid sol. 1 : 40
5	Partzevsky, 1882 (?)	M. 23	13 wks	Pleuritis.	Yes, twice.	4th interspace.	Not given.	Salicylic acid sol.
6	West, 1883	M. 14	Not given.	Pleuritis, pneumonia, abscess of thigh, arthritis.	Not given.	Opened with bistoury from wound to evacuate supposed pleural effusion.	24 fl.oz.	Not given.
7	Savory (?), 1883 Reported by Brinton and Collyns.	M. 9	7 wks.	Abscess of shoulder and thigh, pleuritis, pneumonia; serum obtain'd from pleura at two previous tappings.	No.	5th interspace in ant. line of axilla; through pleural cavity, which was opened because effus'n believed to be pleural.	24 fl.oz.	Yes, Condy's fluid.
8	Scott, 1883	M. 6	5 wks.	None.	Yes, with trocar one day previously; irrigation with carbolic acid solution, 1 per cent.	5th interspace near apex beat.	Not given.	Yes, carbolic acid sol. 1½ p. ct.
9	Newman (or Stirling), 1885	M 32	2 mos.	Typhoid fever; pleuritis.	Yes, aspirated 4 times; 5th time a silver canula for drainage; carb. acid sol. & tinct. iod. sol. for irrig. First aspiration 1 month previously.	3d left interspace; incision made where fistula existed from canula which had been draining the sac for three days.	17¼ fl.oz. had been evacuated by the five previous tappings.	Tincture of iodine (B.Ph.) 1 : 10
10	Mikhailov, 1885 (?)	F. 35	About 3 wks.	Pleural, bronchial, and renal lesions.	Yes, two days previously.	4th interspace near sternum.	2 fl.lbs. ?	Boric acid sol.
11	Gussenbauer 1885 (?)	M. 13	Not given.	Acute osteomyelitis at shoulder (left).	Not given.	5th rib resect'd; open'd pericardium through pleural cavity because thought to be pleural effusion.	Not given.	Thymol solution.

Permanent drainage after incision.	Time of after-treatment.	Result.	Reference.	Remarks.
Yes, wound kept open by inserting probe.	Nearly 3 mos.	Recovery.	Ueber die Paracentese des Pericardiums. F. A. Hilsmann, Kiel, 1875. (Inaug. Dissert.)	The pericardium was opened behind the sternum, though the external wound was a short distance to left of sternum. As the sac was gradually drained its walls contracted and the pericardial opening moved to the left. In a few days the opening was 1½ inches to left of sternum and over the 4th rib. In order to empty the sac thoroughly when the external wound was dressed the patient had to bend over as if he was about to stand on his head.
Not given.	Not given.	Recovery.	Vorlesungen über Akiurgie B. von Langenbeck, Berlin, 1888, 449.	Patient had been wounded in a duel in which the bullet shattered five ribs. Necrosis had subsequently occurred and purulent pericarditis resulted.
Yes, two drainage tubes.	About 2 mos.	Recovery.	Berl. klin. Woch., Jan. 31, 1881, 62	Pleuritis apparently occurred after tapping and incision of pericardium.
Yes, with drainage tube.	5 mos.	Recovery.	Med.-Chirurg. Trans., 1883, 235.	Rod-shaped bacteria found in pus. Patient in good health nine years afterward. West believes that pericardial adhesions had occurred, but there was no evidence of this condition.
Yes, with drainage tubes.	30 hrs.	Death.	London Medical Record, Feb. 15, 1883, 83.	Autopsy showed cardiac hypertrophy with fatty degeneration, pleural adhesions, pulmonary œdema.
Not given.	14 dys.	Death.	Brit. Med. Journ., Dec. 8, 1883, 1129; and Feb. 21, 1891, 404.	At autopsy found extensive pericardial adhesions. [Case of a septic nature most probably. —J. B. R.]
Yes, with drainage tube.	15 dys.	Death.	St. Bartholomew's Hosp. Reports, 1883, xix. 271.	This patient is evidently the one referred to by West in Medico-Chirurgical Trans., 1883, as having been operated upon by Savory. Case was one of pyæmia. Autopsy showed no communication between left pleura and tract leading through it to pericardium because adhesions had occurred.
Yes, two openings an inch apart with drainage tube through both.	Not given.	Recovery.	New Zealand Med. Journ., July, 1891, 268.	
Yes, with rubber tube.	5 days.	Death.	Australian Med. Journ., July 15, 1885, 303.	First aspiration was done in 6th left interspace; second in 4th right interspace; in third and fourth aspirations no information as to point is given; fifth tapping done in 3d left interspace; incision. At autopsy a sinus found in 2d interspace leading from pericardium to the subcutaneous tissue. This was nature's effort to obtain a spontaneous opening for the pus. Author suggests to us that it may give a hint as to best point for tapping.
Yes, with drainage tube.	18 hrs.	Death.	Annals of Surg., Nov. 1885, quoted from Lond. Med. Record, Aug. 15, 1885, from native journal.	Autopsy showed cardiac dilatation with fatty degeneration, pleural and bronchial disease, and kidney lesions. Bacteriological examination of heart and pericardium was negative. Original in Med. Oboz., Moscow, 1885, xxiii. 475.
Yes, by stitching pericardium to edges of wound.	Not given.	Recovery.	Wiener med. Wochen., Nov. 22, 1884, 1403.	Small fistule remained when case reported.

No.	Operator and date.	Sex and age.	Duration of illness.	Complication.	Tapped previously.	Situation of incision.	Quantity of pus evacuated.	Irrigation.
12	Rouse (Dickinson's patient), 1887	M. 10	About 15 wks.	Gluteal abscess, pleuritis; abscess of finger; pleura tapped 12 times, serum obtained.	Yes, three times; last time one week previously.	5th interspace right side close to sternum.	Not given.	No.
13	Underhill, 1887	F. 6	2 days.	Pyæmia; had periosteal abscess of tibia a few weeks previously; autopsy: abscesses in kidneys and pleura.	Yes, aspirat'd twice, last time five days before incision.	5th left interspace close to border of sternum.	Over 10 fl oz.	No.
14	Parker, 1888	F. 9	6½ wks.	Osteomyelitis of tibia and suppurative arthritis of knee.	Yes, four days previously.	4th interspace along left border of sternum with resection of one inch of 5th costal cartilage.	"A large qu'ntity" floccul'nt pus and lymph.	Yes.
15	Halsted (reported by Osler), 1890	M. 36	Over 3 wks	Acute necrosis of bones of nose; albuminuria; congestion of right lung.	No.	4th interspace midway between nipple and sternum.	Over a quart.	No.
16	Delorme, 1890	M.	18 days.	Double pleuritis; empyema; operation.	No.	4th interspace a little outside of internal mammary vessels.	Few drops.	No.
17	Davidson, 1890	M. 6	Over 4 wks.	Metatarsal necrosis; subperiosteal abscess 8th rib right side; empyema; pneumonia.	No.	5th interspace.	8 fl. oz.	No.
18	Davidson, 1890	M. 6¾	Nearly 4 wks.	Empyema; operated upon previously.	No.	4th interspace 1 inch from left edge of sternum.	Several fl. oz.	No.
19	Teale, 1890 (Bronner's patient)	F. 11	34 dys.	Influenza, pneumonia. Empyema operated on previously.	No.	4th interspace 1 inch from left edge of sternum.	Nearly 2 pints.	Yes, iodoform and glycerin, solutions of boric acid and carbolic acid.
20	Deaver, 1890	M. 21	18 dys.	Synovitis (?) of knee.	Yes, aspiration one day previously.	5th interspace 3 in. from middle line.	Not much but ℥xvij removed by aspiration day before.	No.
21	Sievers, 1892	F. 22	5 wks	Pleuro-pneumonia, empyema on both sides; nephritis.	Yes, seven days previously with trocar.	3d interspace 2 cm. to left of sternum.	Great quantity.	No.
22	Körte, 1891	F. 7	.....	Osteomyelitis of both tibias.	Yes.	Resection of 5th rib for 5 centimetres.	½ litre.	Lysol solution ½ per ct.

Permanent drainage after incision.	Time of after-treatment.	Result.	Reference.	Remarks.
Yes, with drainage tube.	2½mos.	Recovery.	Trans. Clin. Soc. Lond., 1889, p. 48; mentioned also in Holmes' Treatise on Surgery.	Case considered one of pyæmia. Patient lay on face at times to encourage drainage.
Yes, with drainage tube.	5 days.	Death.	Edinburgh Hosp. Rep., 1896, iv. 200.	Several hemorrhages from interior of pericardium. Autopsy showed that the bleeding probably came from granulation tissue, on inner surface of pericardium, probably the seat of septic emboli.
Yes, stitched pericardium to edge of wound.	Death occur'd during irrigation immediately after incision.	Death.	Trans. Clin. Soc London, 1889, xxii. 60.	Pus did not flow well; it was thick and contained membraniform shreds; hence irrigation was adopted. Operator believed death was caused by irrigating fluid collecting in pericardium, as opening in pericardium became plugged with lymph. Patient was pyæmic. No special lesion found at autopsy, except pericardial changes. As opening in pericardium became plugged with lymph pressure on heart proved fatal.
Yes, with gauze plug.	17 dys.	Death.	Univ. Med. Mag., vi. 248.	Great improvement after operation. Dr. Osler, who reports case, calls the pericarditis septic and attributes the fatal result to probable myocarditis. No autopsy was made.
No.	Few moments.	Death.	Revue de Chir., 1895, xv. 1008.	Patient died of asphyxia which had caused pericardial operation to be hurriedly undertaken. Autopsy showed front of heart adherent to pericardium, and about 500 grms. of sero-pus collected at base and sides of heart, and a great quantity of false membranes that could only have been removed by a large opening followed by washing and direct extraction. The opening in 4th space was over the adherent region.
Yes, with drainage tube.	7 days.	Death.	Brit. Med. Journ., March 14, 1891, 578.	Autopsy showed no pericardial adhesions; pneumonia. Case was considered septic.
Yes, with drainage tube.	Over 7 wks.	Recovery.	Brit. Med. Journ., March 14, 1891, 578.	
Yes, with drainage tube.	26 dys.	Death.	Brit. Med. Journ., Feb 14, 1891, 350.	No autopsy made; but a probe passed into pericardium discovered no adhesions, though soft granulations were felt toward base of heart.
Yes, rubber tube.	13 dys.	Death.	Univ. Med. Mag., 1894, vi. 297.	Autopsy showed much fibrinous exudate within pericardium. [Case of a septic nature most probably.—J. B. R.].
Yes.	8 dys.	Death.	Zeitsch. für klin. Med., 1893, xxiii. 26.	Found bacilli in fluid. Autopsy showed acute nephritis, pleuro-pneumonia, pericardial adhesions, and some change in heart muscle. Pericarditis was of a septico-pyemic nature. Operator chose 3d interspace because 4th and 5th spaces were very narrow.
Not given.	12 dys.	Death.	Verhand. d. Berl. med. Gesellsch. (1892), 1893, xxiii. 2.	Autopsy showed numerous foci of pus in fissures of cardiac muscle, in papillary muscle of mitral valve, and in kidneys; caseous mass in lung and evidences of pleuritis were found. Pus evacuated contained staphylococci, streptococci, and bacilli. [Case evidently septic.—J. B. R.]

No.	Operator and date.	Sex and age.	Duration of illness	Complication.	Tapped previously.	Situation of incision.	Quantity of pus evacuated.	Irrigation.
23	Eiselsberg, 1894	M. 17	Over 4½ mos.	Wound by knife in reg'n of heart had healed; left pleuritis and pneumonia followed third tapping.	Yes, three times.	Resection of 4th cartilage.	2 litres.	Yes, sol. of salicylic acid, then iodoform and glycerin
24	Edwards, 1892 (?)	F. 6	Not given.	Sacculated empyema; opera'n with resec. of ribs; mediastinitis—nephritis.	No.	¼ in. within and above position of apex beat.	℥ix.	No.
25	Jacobson	F. 14	Not given.	Œdema of lungs.	Not given.	5th interspace right side a little outside of sternum.	℥xlvj.	Not given.
26	Gabszewiez, 1892	M. 22	1 mo.	None.	No.	Resection 5th costal cartilage.	Large quantity.	Yes, boric acid sol.
27	Robinson, 1893	M. 16	20 days.	Sore-throat; swelling of left wrist first symptom.	Yes, aspiration one day previously.	Resection of 6th rib.	2 quarts.	No.
28	Marsh	M. 14	Not given.	Not given.	Not given.	Below the nipple.	Not given	Not given
29	Klefberg	M. 19	.....	Influenza previously.	Yes, aspiration 150 grms. pus.	4th interspace.	1 litre pus.	.....
30	Bohm, 1894	M. 33	1 mo.	Influenza previously; pleuro-pneumonia.	Yes, three times.	3d interspace.	1 litre.	Yes, boric acid solution.
31	Allen, 1892	M. 11	Not given.	Empyema requiring costal resection one year before.	Yes, aspiration.	Resected 6th rib below and inside left nipple.	2 quarts.	Yes, with sterile water.
32	Stoker (O'Carroll's patient), 1892	M. 20	34 days.	Pneumonia; left pleural effusion subsequent to operation.	Yes, aspiration five days previously.	4th interspace midway between nipple and sternum.	Not given	No.
33	Björkman (or Hackzell), 1895 (?)	F. 12	About 3½ wks	Influenza and pleuro-pneumonia previously.	Yes, in 4th interspace.	Resection 5th and 6th ribs.	400–500. c. c.	Yes, boric acid solution.
34	Porter (Shattuck's patient), 1895	M. 26	33 days.	Pneumonia before pericarditis; empyema afterward requiring resection.	Yes, aspiration two days previously.	5th interspace 1½ in. to left of sternum.	1 quart.	Yes, with sterile salt solution.
35	Garber, 1897	F. 21	2 wks.	Pericarditis caused by penetrating wound with steel crochet needle.	Not tapped previously.	5th interspace 1½ in. to left of sternum.	About 1 fl.oz. thick pus and also purosanguinolent fluid.	Yes; salt solution.

Permanent drainage after incision.	Time of after-treatment.	Result.	Reference.	Remarks.
Yes, two tubes.	About 6 wks.	Recovery.	Wein. klin. Woch., Jan. 10, 1895, p. 21.	Drains kept in pericardium for seventeen days.
Yes, rubber tube.	Not given.	Death.	Trans. Med. Soc. of State of California, 1893, 166.	Began as mediastino-pericarditis with secondary pleurisy; at least this was the belief of Edwards after an autopsy.
Not given.	Not given.	Death.	Jacobson's operations of Surgery, Lond., 1897, 590.	Death occurred from œdema of lungs.
Yes, by iodoform gauze for 18 days.	Not given.	Recovery.	Gaz. Leklarsk, Warsaw, 1892, 2 ser. 12, 1070.	
Drainage tube.	About 2 mos.	Recovery.	Lancet, Nov. 21, 1896, p. 1460.	
No.	4 days.	Death.	Lancet, Nov. 21, 1896, p. 1460.	
.....	6 days.	Death.	Tidskrift i Militär. Helsovord, 17 Arg. 1892, Stockholm, from Shattuck and Porter. Boston Med. and Surg. Journ., May 6, 1897, p. 444.	Autopsy showed pus in right ankle-joint and right sterno-clavicular joint. [Probably septic.—J. B. R.]
Gauze drain.	3 mos.	Recovery.	Deutsche med. Wochen., Nov. 26, 1896, p. 769.	Schleich's infiltration method of local anæsthesia was used. Out of bed in four and a half weeks. Wound closed in three weeks; well a year later.
Gauze drain.	20 days.	Death.	Personal communication from Dr. D. P. Allen, Cleveland, Ohio.	
Drainage tube inserted on 3d day.	30 days.	Death.	Dublin Journ. Med. Sciences, July, 1896, p. 11.	Fränkel's diplococcus found in pus.
Yes, two large drainage tubes.	6 weeks	Recovery.	Hygeia, Stockholm, lviii. pt. 2, p. 189, 1896.	Pleural cavity was opened during resection and some serum evacuated. The pleural opening was then sutured.
Two rubber tubes.	On 36th day wound entirely healed; empyema; sinus finally closed in about 10 mos.	Recovery	Boston Med. and Surg. Journ., May 6, 1897, p. 438.	Pneumococcus in pus; pneumothorax and empyema occurred after pericardotomy; then erysipelas of back and shoulder. Pneumococcus in pus from pleural sac.
Yes, with gauze.	24 days.	Recovery.	Journ. Amer. Med. Assoc., June 26, 1897, p. 1223.	

the sixth and seventh costal cartilages. This would complicate a little, though not to a great extent, the lifting up of the trap-door. Such a bridge sometimes occurs between the fifth and sixth cartilages.

Operators who have made similar resections of the chest-wall in operations for suppurative pleuritis have proved by skiagraphy that consolidation takes place if the perichondrium be retained. Restoration would certainly be much more probable in the operation which is here advocated, since not only the perichondrium but the cartilages themselves, with many of their connections, have been retained.

The evacuation of the fluid after opening the pericardium can be made complete at times by a change in the posture of the patient or breaking down adhesions by a probe or the finger introduced into the sac. It does not seem to be especially dangerous to allow the pus to flow out rapidly, but it is wise to permit the escape to be gradual.

Aspiration can be readily done under local anæsthesia by cocaine or freezing. Resection in the manner advocated will probably require general anæsthesia. If the severity of the symptoms renders general anæsthesia dangerous, it may be well to withdraw a portion of the fluid by the aspirator needle used for diagnosis in the xiphoid fossa, and delay drainage by incision and resection until the patient's condition will permit the administration of an anæsthetic. The patient should be allowed to remain recumbent or semi-recumbent during the operation. The tubes should be prevented from slipping into the pericardium by being stitched to the skin or having a safety-pin thrust through their outer ends.

Operations upon the pericardium for pyopericardium would seem, on general principles, to promise better results in a mechanical way than similar operations upon the pleura, for the pericardium is elastic and more easily drained than the pleura. If it becomes thickened and does not collapse after evacuation of pus, I would be inclined to incise any remaining fistule and cut away the thickened pericardial tissue.

Pericardial fistules should be treated as fistules elsewhere. After sufficient time has been given to make it clear that spontaneous healing will not occur, the fistule should be laid open and thickened tissue removed.

THE RÖNTGEN RAYS IN THORACIC DISEASES.[1]

By Francis H. Williams, M.D.,
BOSTON.

About a year ago I had the pleasure of presenting to this Association a paper in which I related some of the early steps in my study[2] of the adaptation of the x-rays to medical practice; x-ray examinations were then a novelty, but they must now be accepted as a valuable supplement to our other methods of examination. To-day I wish to outline some of the results of the work of the past year, during which I have examined by means of the x-rays more than five hundred patients—about one hundred of which were surgical cases—at the Boston City Hospital and at my office.[3] The majority of the four hundred medical cases were suffering from some thoracic disease; certain of these patients—those ill with pneumonia, for instance—have been examined a number of times, as I wished to watch the progress of the disease and see the conditions presented in its different stages.

No harmful effects have been received in any way by these patients, and there need not be the slightest anxiety on the part of any one if proper precautions are taken. I have seen, however, several persons who have suffered a more or less severe inflammation of the skin, the nails also being sometimes involved, but they were all individuals whose occupation brought their hands into close proximity to the Crookes tube, or who, for the purpose of testing its possibilities for harm, had exposed some part of the body to its action at a distance of a few inches for a considerable period; but there are simple ways of obviating these effects.

Before taking up the uses of the x-rays in diseases of the thorax, let me call your attention to one of the principles upon which their usefulness depends.

The varying resistance which the different tissues of the body offer

[1] Presented at the meeting of the Association of American Physicians, May 5, 1897.

[2] During the progress of this study I have reported my results at medical meetings or by published articles, as follows:

Meeting of the Suffolk District Medical Society, April, 1896.

Meeting and Proceedings of the Association of American Physicians, 1896; "Notes on X-rays in Medicine." Boston Medical and Surgical Journal, October 1, 1896, "A Method for More Fully Determining the Outline of the Heart by Means of the Fluoroscope, together with other Uses of this Instrument in Medicine."

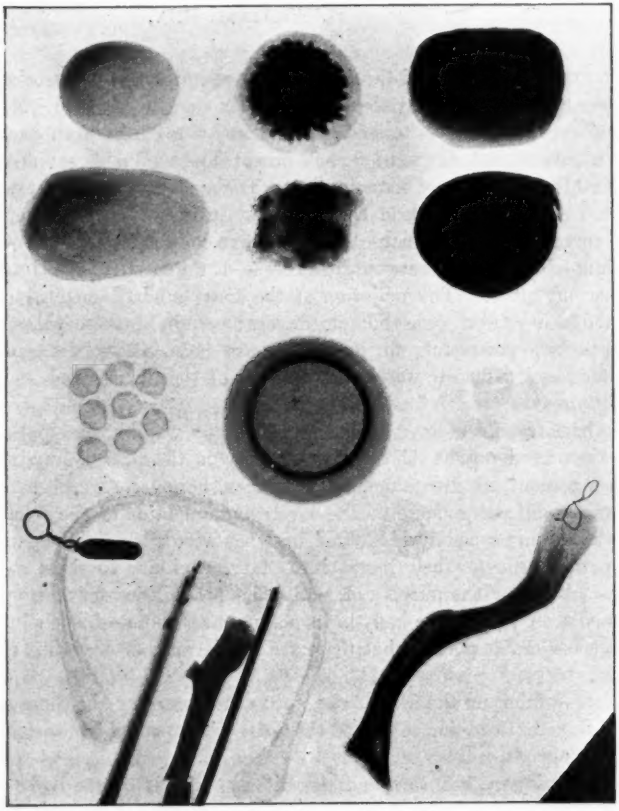
Meetings of the Boston Society for Medical Improvement, and of the Medical Society of the Boston City Hospital, October and November, 1896.

Medical and Surgical Reports of the Boston City Hospital, January, 1897, pp. 134-190. "A Study of the Adaptation of the X-rays to Medical Practice."

[3] In making these examinations I have used a Wimshurst machine and an induction coil, but principally the former, both of which were designed by Messrs. C. L. Norton and R. R. Lawrence, of the Massachusetts Institute of Technology.

to the passage of the x-rays depends upon difference in bulk and in chemical composition; organic substances made up of carbon, hydrogen,

FIG. 1.



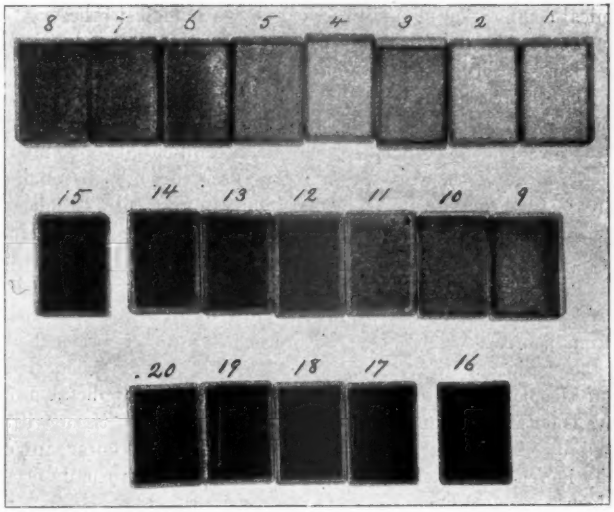
The two upper rows of objects in this radiograph are calculi. The two calculi on the left are composed of uric acid and urates; those on the right of phosphates; and the two in the middle of oxalate of calcium and uric acid, the upper one of these last two having an outside coating of urates. In the centre of the picture is a round aluminum cup, containing water, one inch in depth, and on either side of this cup is a group of gall-stones, and to the right and below the cup a single large gall-stone is seen indistinctly. In the left-hand lower corner is a decalcified bone, bent into the shape of an inverted U, with a lead tag attached by a copper wire. The decalcified bone surrounds an incinerated bone, which is lying on a piece of cotton-wool in a wooden box with a glass side. In the right-hand lower corner is a dry bone; in the extreme right-hand corner is a triangular piece of lead. The picture is reduced to one-half of its original size.

and nitrogen, which have a low atomic weight, allow the rays to pass readily, while those like bone, containing calcium, which has a com-

paratively high atomic weight, offer more resistance to the rays. The soft tissues of the body contain a large percentage of water, and most of them offer about the same resistance as an equal thickness of water. The various fluids found in the body in health and disease, such as the blood, ascitic and pleuritic fluid, pus, urine, fluid from hydrocele, etc., offer about the same resistance as water.

The following experiment with calculi (see Fig. 1) illustrates in a striking manner how important to us is a knowledge of chemical composition in our use of the Röntgen rays in medicine. Before

FIG. 2.



Radiograph of equal bulks of various substances which represent the constituents of the body in a general way:

	Weight.		*Weight.*
1. Carbonate of magnesium	1.6 grammes.	5. Gelatin	4.0 grammes.
2. Stearic acid	3.8 "	6. Dried egg albumen	6.4 "
3. Oleic acid	3.5 "	7. Carbonate of sodium	5.9 "
4. Palmitic acid	4.4 "	8. Milk sugar	11.7 "
9. Glycerin	4.0 "	13. Phosphate of calcium	2.6 "
10. Water	14.0 "	14. Sulphate of sodium	10.8 "
11. Oxalic acid	12.2 "	15. Magnesium ammonium phosphate	12.5 "
12. Phosphate of sodium	10.6 "		
16. Chloride of sodium	8.5 "	19. Carbonate of calcium	15.3 "
17. Sulphur	13.9 "	20. Fluoride of calcium	11.7 "
18. Chloride of potassium	10.1 "		

attempting to detect any form of calculi in the body I first placed several different kinds over a photographic plate, which was enclosed in dark

paper to shield it from the light, and exposed them for a few minutes to the x-rays. The rays penetrated the calculi made up of uric acid, of cholesterine and biliary salts very readily, but were obstructed by calculi containing oxalate of calcium in considerable proportion, phosphate of calcium, or other inorganic constituents. These calculi were kindly lent to me by Dr. William F. Whitney.

In order to gain some conception of the susceptibility of the various constituents of the body to the x-rays, I made several radiographs of a considerable variety of substances (see Fig. 2), and one of them I have had reproduced here.

This experiment suggests how we may recognize some changes in chemical composition made in the body by pathological processes. The ability to do this without beaker or reagent, or disturbing the vital processes, is a step in the application of chemistry and physics to practical medicine which hints at what the future may have in store for us.

There is one other point which must not be overlooked in this connection, and that is the difference in resistance which air and water offer to the passage of the x-rays. The rays pass through air much more readily than through water, and, as air makes up a certain bulk of the body and a large part of the chest is filled with it, while water enters into the composition of all parts of the body and forms the chief constituent of the soft parts, it is readily seen of how much importance is this difference in permeability of air and water by the rays, on account of the great contrast which is thereby afforded in health between the lungs and their adjacent tissues or organs. Further, as will be shown later, one of the best opportunities for the advantageous application of the x-rays is obtained from the contrast of the normal lung tissue with that offered by pathological conditions which occur in the thorax, involving chiefly increase in density in the lungs or in the space usually occupied by them.

To use the Röntgen rays successfully in practice it is first essential that the physician become familiar with the appearances in the fluoroscope which present themselves in health by examining a number of healthy persons of different ages and weights. This applies particularly to the thorax, and the picture of this part of the body, when seen on the screen of a large fluoroscope, presents so much that it should be studied systematically. The trunk appears lighter above than below the diaphragm, and the rise and fall of this muscle, which is dark in the fluoroscope, are distinctly seen. The chest is divided vertically by an ill-defined dark band, which includes the backbone, on each side of which the lungs, forming the brightest part of the picture, are crossed by the darker ribs; this band varies in width according to the intensity of the light, narrowing as this becomes stronger; with a strong light the vertebræ from the neck to the heart are made out. The pulsating heart is

seen, especially the dark ventricles, the outlines of the venæ cavæ and of the pulmonary artery, and under favorable conditions the lighter right auricle. A small portion of one side of the arch of the aorta may be observed in the first intercostal space to the left of the sternum. After this general view has been taken the outline of the lungs should be noted during full inspiration and expiration, and the excursion made by the diaphragm during quiet breathing and during full inspiration and expiration (see Fig. 3).

FIG. 3.

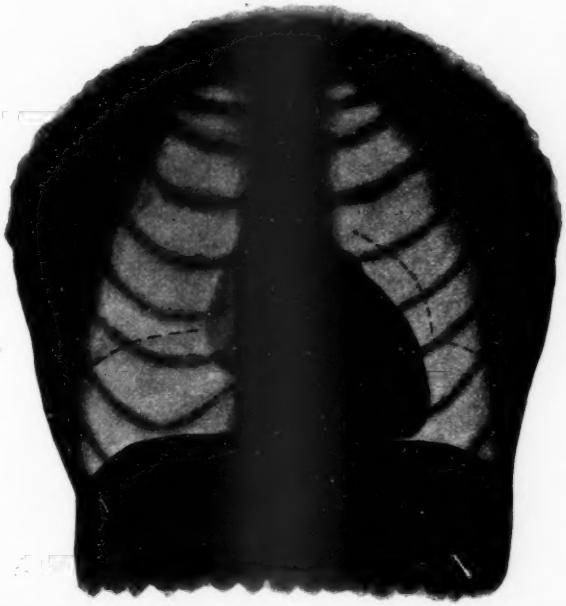
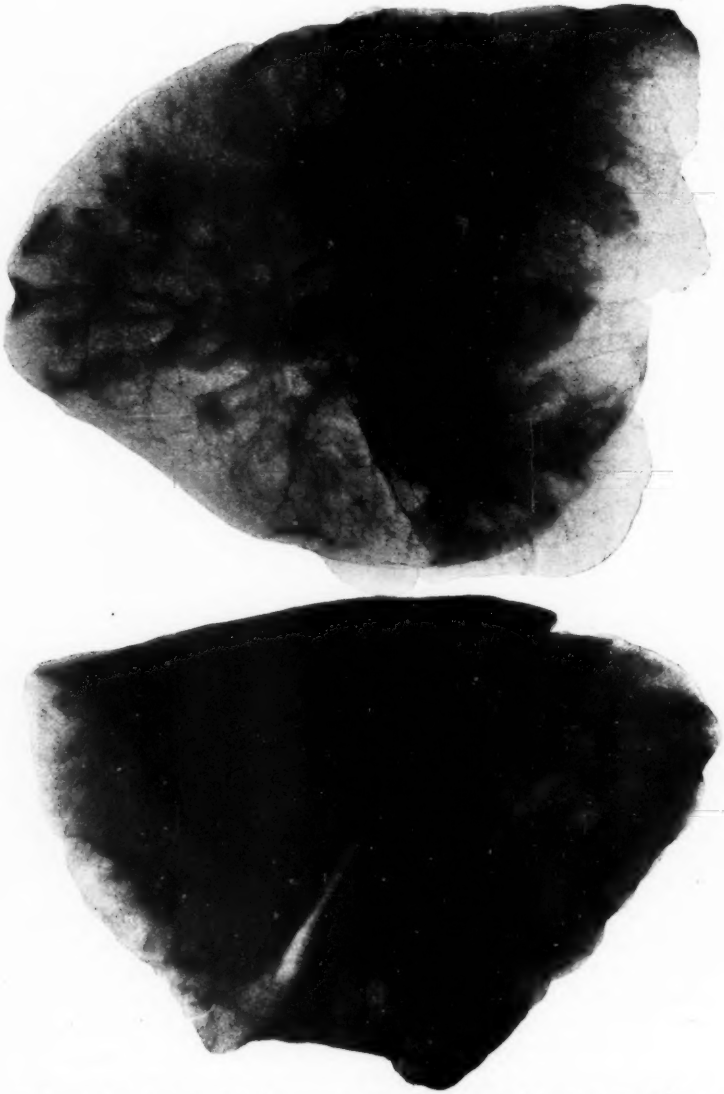


Diagram showing the heart and the outline of the diaphragm of normal chest, as seen in the fluoroscope during full inspiration. The broken lines show position of heart and diaphragm in expiration.

The lungs usually appear brighter during deep inspiration; in young persons brighter than in older persons, as the tissues of the former are more easily penetrated by the rays. In the stout, the lungs appear darker than in the thin, because the outlines are dulled, as it were, by a thicker layer of tissues, which contain much water. It has seemed to me that the right apex is normally darker than the left apex. The normal brightness of the lungs and the normal outlines of the clavicles and ribs should be observed, for, as we note different degrees of pallor by reference to our standard of color in health, in the same way is it

FIG. 4.



The lungs of a patient who died of pneumonia. The lightest portion is healthy. The darker parts have been more affected by the pneumonic process than the lighter.

necessary to know the normal amount of light which should penetrate any given part in order to recognize variations from the normal. The eye must be trained in the use of the x-rays as is the ear for auscultation and percussion, and the fluoroscope, like the ophthalmoscope, should be in constant use in order that the practitioner may not lose any of the skill acquired in interpreting the conditions presented.

To test the possibilities of an examination with the fluoroscope in certain conditions of the lungs, as when congestion or more or less œdema or pleurisy was present, I made one or two simple experiments. On full inspiration in healthy patients I found the pulmonary area lighter than in other stages of respiration, and the ribs stood out in greater contrast, thus showing that there must be less blood in the lung during the former period, and that if any part of the lung is much congested, or if œdema is present, it would naturally appear darker than the normal lung; also when I held a small pasteboard box, about one-half inch deep and full of water, over one side of the thorax of a well-developed and muscular man with a large chest, I could see its shadow in the fluoroscope during about full inspiration, but not at other times.

In order to get further suggestions in regard to the possibilities of the x-ray examinations in diseases of the lungs, I took a number of radiographs of healthy and diseased lungs just after death, which were removed from the body and put over a photographic plate. As a specimen of the latter, see Fig. 4, which shows the lungs of a patient who died of pneumonia. The darker was more affected by the process than the lighter; the lightest portion is healthy. These lungs were kindly sent to me for a few moments by Prof. W. T. Councilman.

Again I examined with the fluoroscope, two days before his death, the chest of A. B., one of my patients who died of syphilis, and found his lungs perfectly clear and the outlines well defined. The outlines, also, of the front and back portion of the ribs forming a lattice-work, as shown in the fluoroscope, were well seen. The autopsy confirmed the examination made by the fluoroscope, and showed that he had perfectly healthy lungs.

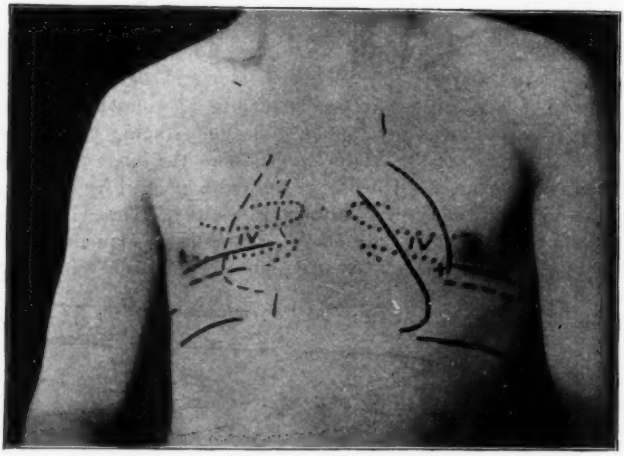
We shall see presently that in certain diseases parts or the whole of one or both lungs appear darker or lighter than in health, and that their volume may be greater or less than in health. The respiratory excursion of the diaphragm may vary from the normal on either or both sides of the chest, in position—that is, it may be higher or lower in the body, and in amplitude, or it may vary in the curve, or its lines may be wholly or partially obliterated.

In making examinations of the lungs, changes in the amount of light seen in the fluoroscope should be carefully observed: for example, whether or not one lung is darker than the other. In pathological conditions the indications of change in density, shown usually by dimin-

ished brightness, may be estimated by comparing the two sides and observing whether the outlines of the organs and whether the ribs and clavicles are more clearly seen on one side than on the other. When both sides are diseased the opportunity for direct comparison with the normal is lost, and one is obliged to depend upon the recollection of the normal in an individual of the same build. The position, excursion, and curve of the diaphragm should also be carefully noted, as compared with the normal.

In six men with healthy lungs the diaphragm moved over an average range of two and three-fourth inches on the right side and two and one-half inches on the left side. (See Fig. 5.) The maximum excursion in any healthy person I have examined was four inches. In eighteen patients with tuberculous lungs the average excursion of the diaphragm was one and one-fourth inches; in some cases less than half an inch.

FIG 5.

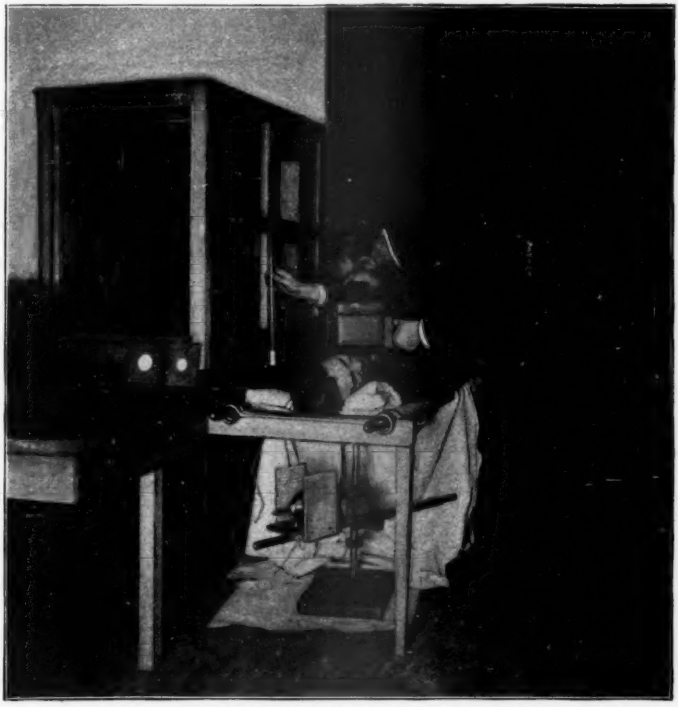


Chest of healthy man, aged twenty-one years. Examination with the fluoroscope: The dotted lines on each side of the chest indicate the outlines of the fourth rib; the full upper horizontal lines on either side of the chest about over the fourth rib, the position of part of the diaphragm in expiration; the broken lines just below these, the height of the diaphragm at inspiration during quiet breathing; the full lines below and parallel to these, the outlines of the diaphragm during deep inspiration. The full curved line which is nearer the left nipple indicates the left border of the ventricle during quiet breathing; the full curved line nearly parallel to this, the left border and apex during deep inspiration.

Patients may be examined standing, sitting, or lying down, with the rays passing through the body antero-posteriorly or from side to side. Most of my examinations have been made with the patients lying on a

stretcher (see Fig. 6), and the Crookes tube on an adjustable holder under the patient. For careful examination of the thorax, for example, the Crookes tube should be about two feet away from the fluoroscope,

FIG. 6.



Showing method of examining a patient who has been brought into the dark-room on the stretcher, on which he lies. The Crookes tube is on an adjustable holder below the patient; the static machine on the table near him. About two inches below the patient there should be a brass plate (not shown in the figure), rather more than a foot square and one-quarter of an inch thick, with a circular opening about six inches in diameter. This plate is attached to a flat iron bar in such a manner that it may be swung horizontally and brought under any part of the body it is desired to examine carefully. The rays pass only through the circular opening, and the part to be specially examined is thus more clearly defined. This metal diaphragm is used after the general examination of the body has been made without it. The plate should be grounded.

and its position should be determined by plumb-lines, so as to bring it immediately under the middle of the sternum, on a level with the fourth rib. The fluoroscope is peculiarly applicable to moving organs, such as

the heart and lungs, and is useful in examining children. I now use this instrument in my office as I do the stethoscope.

Let us now take up individually some of the thoracic diseases, and we will first consider pulmonary tuberculosis.

Pulmonary Tuberculosis.

In this the fluoroscope may suggest disease in the following ways: First, a diminution in the volume of the diseased lung is shown by the position and movement of the diaphragm; this movement may be less than normal on one or both sides, and will be restricted on the lower

Fig. 7.

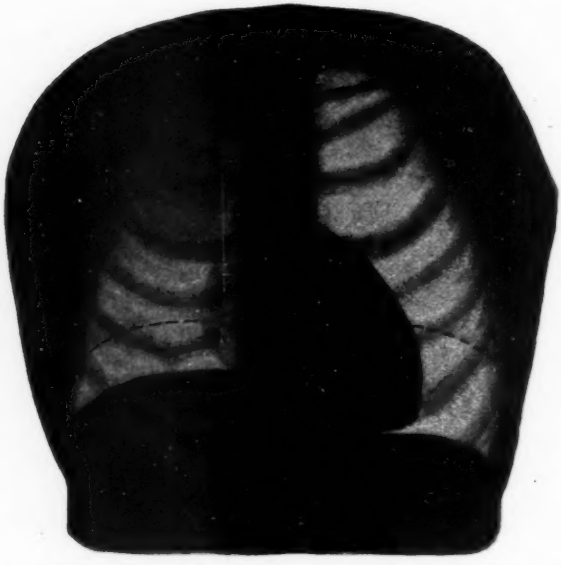


Diagram illustrating appearances seen in the fluoroscope in a case of tuberculosis of the lung. The apex of the right lung is seen to be darker than normal, and the range of movement of the diaphragm on the right side to be less than normal. The position of the diaphragm in full inspiration is shown; broken lines give its position in expiration.

side. Second, an increase in density by diminution in the normal brightness, the degree and extent varying in accordance with the increase in, and extent of, the density. The lung may become so dense that no more rays pass through it than through the liver. The brightness or light in the lungs indicates the amount of air in the chest. The diaphragm lines may be partially or wholly obliterated, as well as the outline of the heart.

I have examined more than one hundred cases of tuberculosis[1] with the fluoroscope, and found a correspondence between the physical signs and the x-ray examination in a considerable number of cases; in certain cases this instrument showed that the disease was more extensive than the physical examination indicated; *in others it showed increase in density in the lungs earlier than was detected by the physical examination; and while in some of these no signs in the lungs were detected prior to those found by the fluoroscope, in others, although one lung was ascertained by the physical examination to be seriously involved, its companion was not suspected until the x-ray examination revealed its increased density.* In most cases of pulmonary tuberculosis the fluoroscope enables us to estimate the amount of lung involved better than any other method of examination. Most of the tuberculous patients that I examined at the Boston City Hospital presented well-marked signs of the disease when they entered, but in prviate practice the proportion of patients who are seen in the early stage, when there is greater opportunity for successful treatment, is larger; and therefore the fluoroscope might be of special value in these cases on account of the earlier diagnosis it assists us to make.

The following case, which one of my colleagues kindly permitted me to examine with the fluoroscope, shows that this instrument detected increase in density in the right lung when it was not found by auscultation and percussion. It likewise indicates the significance of the diaphragm lines in tuberculosis:

H. A., aged twenty years. Tuberculosis (?). Duration, four weeks: family history not tubercular. Medium dry râles at left apex, with slight dulness; *right apex normal.*

Examination with fluoroscope: Left lung extending to level of the fourth rib very dark; *there is also some involvement of right apex.* The maximum respiratory movement of the diaphragm on the left side is only three-quarters of an inch; *on the right side one inch only.* This is less than half the normal.

[Later tubercle bacilli were found.]

Let me also give the following case in which increase in density was detected earlier by the x-ray examination than by the older method. I examined this patient because he had a pericardial effusion, but the increase in density at the apex of the right lung was so marked in the fluoroscope that it attracted my attention. The usual physical examination was then made, but I could find no evidence of pulmonary tuberculosis. I examined the lungs by the fluoroscope from week to week, and saw that the denser, diseased area extended, while the movements of the diaphragm became less and less on that side. After about six

[1] See "A Study of the Adaptation of the X-Rays to Medical Practice," Medical and Surgical Report, Boston City Hospital, January, 1897, pp. 153–165, for short abstracts of some of these cases, as well as those of pneumonia, etc.

weeks the fluoroscope showed that the left lung also had become denser at the apex, and the excursion of the diaphragm on this side was also lessened. No signs were found by auscultation and percussion on this side at this time. There has been no cough, the patient is about as usual in weight, has no night-sweats, and no bacilli have been found; but about two months after his entrance to the hospital he reacted very strongly to tuberculin, and the diagnosis of tuberculosis was established. Four months after entrance: still no bacilli have been found, although many examinations for them have been made. There are, however, some cases where the bacilli are found before marked signs in the lung can be detected by the fluoroscope; it may be that in these cases the disease begins in the larynx.

Again, a woman twenty years old, unusually well developed and nourished, entered the hospital with phlebitis of the leg. Two of her sisters had died of tuberculosis. By auscultation and percussion the heart's area, action, and sounds were normal; resonance and respiration good over the whole of both lungs. After she had been in the hospital two weeks an x-ray examination was made, chiefly because I had established the routine of so examining many of my patients. This examination showed that the maximum movement of the diaphragm on the right side was one and seven-eighths inches, and on the left side two inches. The apices of the lungs were darker than normal on both sides, more so at the right apex than at the left. The outline of the heart showed that this organ was smaller than normal. Tuberculin was given and was followed by a typical and well-marked reaction. The tubercular family history, diminished movement of the diaphragm, increased density of the apices of the lungs, and the small heart, all pointed to the diagnosis of tuberculosis, and this was confirmed by the tuberculin-test. As yet there have been none of the ordinary symptoms or signs of disease of the lungs, except those seen in the fluoroscope.

We can detect an abnormal condition of the lung in some cases of tuberculosis earlier by means of the fluoroscope than by auscultation and percussion. How much earlier these signs can be anticipated depends upon the rapidity of the progress of the disease, and this varies in different persons and under different conditions. Of course, a diagnosis of tuberculosis is not made by the appearances in the fluoroscope alone, they simply indicate an abnormal condition of the lungs. I shall consider more fully the use of the fluoroscope in pulmonary tuberculosis in another article.

Pneumonia.

I have examined more than fifty patients with pneumonia by the fluoroscope, and some of them, as already stated, a number of times while watching the progress of the disease, and found in a few cases that the

lung had not become normal after months. In patients ill with pneumonia the increase in density in the lungs is very marked in the fluoroscope during the active stage of the disease [Fig. 4 suggests the distribution of the darker areas as seen in the fluoroscope], and by its means we may estimate how large an area of the lungs is involved, and by observing the patients at intervals of two or three or more days, as they improve, we may see the dark areas become lighter and lighter, and finally disappear; and we may see the excursion of the diaphragm, which has been restricted and restricted on the lower side, become gradually longer as the lungs clear up. I have examined patients while they were convalescing from pneumonia, both by auscultation and percussion and by the fluoroscope, on the same day, and while by the former I could not detect that the lungs were denser than normal, I was able to recognize the continued presence of abnormal density by means of the fluoroscope, and even when this was no longer possible I could still easily see by means of this instrument that the diaphragm did not descend to its normal limit, thus showing that the lung was still in an abnormal state. Later the normal limit was reached. This method of examination enables us to judge better than any other when the lungs have cleared up after an attack of pneumonia, and if we can obtain, by means of the fluoroscope, later evidence of the presence of a pathological process during its subsidence than by auscultation and percussion, we may also reasonably expect to recognize its onset sooner, and I am satisfied that we can. Further, this ability to detect that the lungs are in an abnormal state weeks after a physical examination has ceased to indicate it, shows the delicacy of the test, and is an added assurance that we can in some cases of tuberculosis recognize an abnormal condition of the lungs earlier by means of the fluoroscope than by auscultation and percussion. A slight central pneumonia is at times overlooked when its early detection by the fluoroscope might, in certain cases at least, prevent its progress to a more severe attack.

During the past winter I have seen three patients where the diagnosis would have been difficult had not the fluoroscope led to that of central pneumonia; one of these cases was seen by three physicians, and we all failed to make the diagnosis. The examination with the fluoroscope caused me to make a diagnosis of central pneumonia, and the further progress of the case confirmed it.

The following case shows the significance of the diaphragm lines in pneumonia:

L. B., aged nineteen years. Pneumonia. Examination with fluoroscope: On seventh day of disease, right lung dark from middle of first intercostal space to fourth rib; the upper and lower border of this dark area were marked; outlines in chest rather less clear than normal on both sides. Diaphragm moved one-quarter inch on right side, and one

and five-eighths inches on left side. Fifteenth day of disease, diaphragm moved one inch on the right side; two and one-half inches on left side. Nineteenth day of disease, diaphragm moved two inches on right side; two and three-quarter inches on left side; original dark area on right side not so bright as other portions of the lung. On the twenty-second day of the disease, diaphragm moved two and one-half inches on right side and three inches on left side.

The abnormal condition of the lungs in tuberculosis and pneumonia may be shown not only by the obstruction which the affected parts offer to the passage of the rays, but also by the restriction of the excursion of the diaphragm. In some cases the latter is a more delicate test.

Pleurisy.

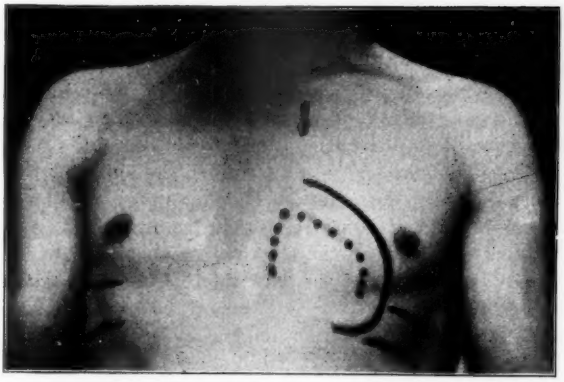
In pleurisy with effusion we can estimate the amount of fluid in a general way by the amount of light which passes through the thorax, and can follow the subsidence of the fluid. When the effusion is large no more rays pass through it than through the liver, and the outlines of the diaphragm, ribs, and heart are obliterated on the side of the effusion. If there is a smaller amount of fluid, the outlines of some of the upper ribs are seen, and with a small effusion the outlines low down in the thorax only are ill defined. The fluoroscope assists us to distinguish between an effusion and a thickened pleura. In some cases of effusion the fluoroscope shows us displacement of the heart, to the left when there is a large effusion on the right side and a much greater displacement to the right, and this displacement is of more frequent occurrence when the effusion is on the left side. This displacement of the heart to the right may not be recognized by percussion even when it has been pushed much beyond its normal place. In one patient the heart was seen to be displaced more than two inches to the right, but no displacement was detected by percussion. While examining some cases of pleurisy with effusion by the fluoroscope, I have found indications of tuberculosis in the lung where it was not previously suspected, and these indications were confirmed later by finding the bacilli or by the tuberculin-test.

Emphysema.

In emphysema we see in the fluoroscope that the lungs are unnaturally clear and that their volume is increased; the dilated right auricle and pulmonary artery are observed, and the whole enlarged heart is seen more clearly than normal, although by percussion its true outline cannot be determined; it is also seen to lie lower than in health, and in the later stages in a more vertical direction. The diaphragm is seen to be lower than normal, and the excursion which it performs between deep inspiration and expiration to be less than normal. In some cases the emphysematous condition may be greater on one side than on the other.

The lower position and the more limited excursion of the diaphragm give a means of making a diagnosis of this condition probably earlier than has hitherto been possible, or in some cases the lack of these signs enables us to exclude it.

FIG. 8.



Emphysema. Dotted line marks cardiac area by percussion; full line, by fluoroscope. Diaphragm lines, in expiration and inspiration, are shown on each side of chest below the nipple; they are lower and nearer together than normal. Broken line below inner end of left clavicle shows position of arch of aorta.

The following case was sent to me with a diagnosis of emphysema with asthma:

B. F. Examination with fluoroscope: Diaphragm moved on the right side two and one-half inches, and on the left side three inches. The excursion of the diaphragm being normal assures us that no serious amount of emphysema is present.

I have seen patients, both young and old, who complained of getting out of breath on exertion, and the cause in some cases would have been obscure but for the fluoroscope; this instrument showed that the dyspnœa in both young and old was due in some instances to emphysema, and in others to œdema of the lungs.

If some other disease is associated with emphysema, as, for instance, some form of bronchitis, the excursion of the diaphragm is characteristic, but the abnormal clearness of the lungs may be wanting.

BRONCHITIS.

The appearances of bronchitis in the fluoroscope vary; they may differ very little from those in health, or both sides of the thorax may

be less bright than normal. The respiratory movement of the diaphragm was not especially impaired in the cases I have seen.

Pneumothorax—Hydrothorax—Pneumohydrothorax—Pneumopyothorax—Œdema of the Lung.

In pneumothorax the fluoroscope shows that the affected side of the chest is lighter than normal, that the heart and vessels may be much displaced, and that the diaphragm is much lower than normal on that side, and has a characteristic curve.

In pneumohydrothorax or pneumopyothorax, when the patient is examined lying down, the whole of the affected side of the chest is seen to be dark; if examined in a sitting position the upper portion of the chest is clear and the lower dark. The appearances remind one of a tumbler half-full of ink; when the patient bends forward or backward the height of the fluid on the chest-wall changes; if the patient is shaken gently the surface of the dark fluid is seen to be agitated. In pneumohydrothorax or pneumopyothorax on the left side the surface of the fluid is seen to be disturbed by the pulsations of the heart.

In hydrothorax and œdema of the lungs the fluoroscope is also of service. In these conditions, as well as in empyema, the outlines of the diaphragm are wholly or partially obliterated. Some partial œdema of the lungs is, I am inclined to believe, a more frequent condition than has been supposed. On first examining a patient of this class, his condition being unknown, I was surprised to find how difficult was the passage of the rays, and when I saw that the picture of the patient's thorax in the fluoroscope was unusually dark, supposed something was wrong with my Crookes tube; but after trying another I realized that the patient's chest was denser than normal; the tube was not in fault. I have examined a number of cases which illustrate the aid the fluoroscope renders in congestion or œdema of the lungs; this instrument showed that one of these conditions was present when it was not made out by physical signs, and it thus assists the physician to recognize the interference that may occur in the pulmonary circulation in cardiac or renal disease.

I have found it instructive to study, by means of the fluoroscope, cases of dyspnœa on exertion, and note the amount of congestion or œdema of the lungs present in them. Cases of this kind have already been referred to under emphysema.

H. E., aged twelve years. Entered the hospital with an old endocarditis following rheumatism. There was a systolic souffle at the apex of the heart transmitted to the axilla; enlarged heart; orthopnœa, œdema of the lungs, and intense dyspnœa. Digitalis given. Three days after entrance examination with the fluoroscope showed that the lungs were denser than normal below the second rib on the right side,

and the third rib on the left side. Four weeks later, second examination with fluoroscope: Lungs perfectly clear, heart smaller. The patient had been up and about for some time.

Aneurisms.

I have examined with the fluoroscope and taken radiographs of one subclavian and several thoracic aneurisms. The heart in some of these latter cases was much displaced. Aneurisms of the arch of the aorta are most clearly outlined when their borders are nearest the fluoroscope; those on the left when examined from the back, those on the right when examined from the front. It is obvious that aneurisms of the thoracic aorta can sometimes be detected earlier by x-ray examination than in any other way. In obscure thoracic cases, where an aneurism of certain portions of the aorta is suspected but does not exist, it may be excluded by an x-ray examination.

Fig. 9.

Thoracic aneurism. Examination with fluoroscope: The curved line in the upper part of patient's left chest, and the curved line on his right chest indicate the outline of the aneurism as seen in the fluoroscope. The lower curved line on the left chest marks the outline of the heart; the lowest curve on the right front, part of the outline of the diaphragm; the dotted line, the cardiac area as determined by percussion. This case shows how a large aneurism may exist in the chest without giving rise to marked physical signs.

I have recently seen in consultation a patient who had had excellent advice in Boston and New York, as well as elsewhere, and the diagnosis was obscure until my x-ray examination showed an aneurism of the aorta. In another case my x-ray examination showed that there was no aneurism where it was thought to exist.

FIG. 10.

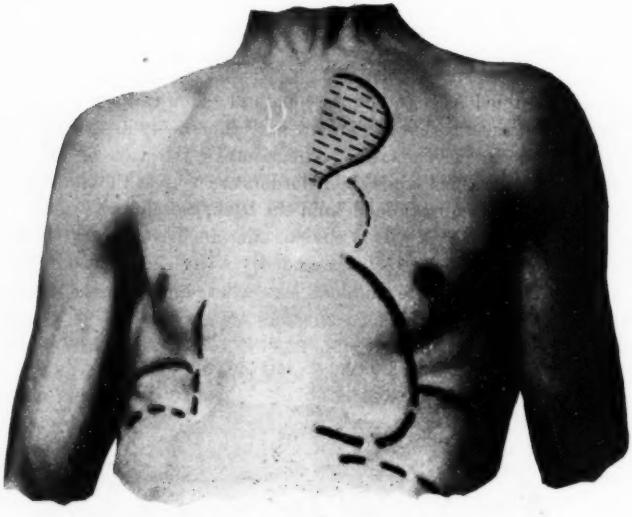
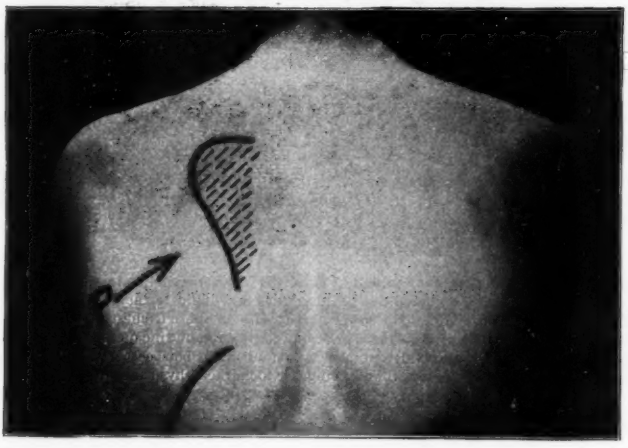


FIG. 11.



Figs. 10 (front) and 11 (back) show a smaller aneurism of the aorta. The arrow in Fig. 11 points to where the pulsation was best seen.

The Heart.

Let us now consider the position, size, and movement of the heart in health as shown by the fluoroscope, before taking up some of the applications of the x-ray examinations in cardiac diseases. The best view of the heart is obtained during full inspiration, as then the diaphragm is so depressed as to expose a much greater part than during quiet breathing, and with more air in the lungs the outlines of the heart stand out better on account of the greater contrast thus produced. On the left side of the sternum the objects seen most clearly are a considerable part of the ventricle, including the apex, and the pulmonary artery; on the right of the sternum the right auricle, from about the second to the fourth rib, and the venæ cavæ; the right auricle and the venæ cavæ are not so dark as the ventricles, as they are not so thick.

When the space occupied by the lungs is in a normal condition the outline of the portion of the heart on the left of the sternum can be followed by means of the fluoroscope with more certainty, accuracy, and more fully than by percussion. The lower border of the heart near the apex is not obtained by percussion, but part of it is seen in the fluoroscope during deep inspiration. Also, on the right of the sternum the position and size of the right auricle, although it is not distinctly outlined, can be better ascertained by the fluoroscope than by other means; likewise the right border of the bloodvessels, which are much more marked in the fluoroscope than the right auricle; but the right border of the ventricle, being behind the sternum in health, is then better determined by percussion than by the fluoroscope.

The position of the heart varies in health in different persons. With deep inspiration it moves downward and toward the median line nearly an inch. While watching the pulsations of the heart in the fluoroscope I observed that the most marked changes in the outlines were not at the apex, but at the left side at the point corresponding to the cavity of the ventricle, the maximum pulsation being about where the outline of the ventricle crosses the fourth rib. I could see the ventricle contract and expand as it emptied and filled.

The change in the position of the heart, due to conditions outside of itself, such as pleurisy with effusion, pneumothorax, emphysema, etc., may be seen in the fluoroscope, as already stated, or the change in position due to its own enlargement. We may also recognize, for example, enlargement of the ventricles and see a dilated right auricle and pulmonary artery, and pulsations in the venæ cavæ. Differences in size may likewise be observed, for instance, the diminution which is found in anæmic patients with tuberculosis, or increase in size which takes place in hypertrophy or dilatation. The ability to observe such changes

as the above enables us to obtain a more accurate knowledge of the condition of the heart in disease than has hitherto been possible.

The so-called apex-beat, which physicians use so much as a point of reference in examining the heart, is not the apex-beat in all cases, but sometimes an impulse given by the side of the ventricle; the apex of the heart is then seen in the fluoroscope to be lower down, usually much below the point where the impulse is felt on the wall.

Calcareous deposits may be seen in some cases, but at present only when the disease is unusually well marked. In one of my patients I saw a dark area in the aorta, and in portions of the heart contiguous to it, which were pushed over to the right of the sternum. The autopsy showed that this dark area seen in the fluoroscope was a calcareous deposit.

The fluoroscope assists us to make a differential diagnosis between a pericardial effusion and an enlarged heart. Not only are the outlines seen to be different in the two cases, but in pericarditis with much effusion the characteristic pulsations of the heart are not seen.

In some diseases of the heart its outlines, to the left of the sternum, as found by percussion, are not correct. In order to compare the size and position of the heart, as obtained by this method and as seen in the fluoroscope, I drew on the skin the cardiac outlines found by percussion, and directly afterward these outlines as seen in the fluoroscope. I have done this in about thirty cases. Both sets of outlines were then traced on tracing-cloth, held carefully over the skin, the one in red and the other in blue lines. (In other patients I photographed the two sets of lines.) Comparison between these lines showed that in some cases the outlines obtained by the two methods, namely, by percussion and by the fluoroscope, agreed very well; in others the difference was marked. It should be stated, however, that although percussion does not indicate in some cases the true size and position of the heart, a proper examination of this organ with the fluoroscope is difficult to make, needing careful adjustment of the x-ray apparatus and experience with a considerable number of cases.

I have used several methods for recording the outlines of the heart seen in the fluoroscope; one record is made by means of a flexible, fluorescent screen which has a smooth surface like a porcelain slate. The screen is placed on the chest of the patient, the room is darkened, and the outline traced with an ordinary lead-pencil. These lines may be afterward rubbed out with a moist sponge and the screen used again. Another method, alluded to above, and one which allows of a ready comparison of results, is to draw the outlines of the organs on the skin by means of a special pencil, while looking through the fluoroscope, and then to place a piece of tracing-cloth, about a foot square, on the chest, and trace upon it the outlines that have been made on the skin. It is well in

these tracings to include the sternal notch, the nipples, the fourth rib, the ensiform cartilage, and the border of the ribs on either side and below the latter, as these serve as points of reference and comparison. Care must be taken that the tracing-cloth be held smooth and that the skin be not moved or stretched. These cloth tracings may be placed one over another and readily compared, as, for instance, the abnormal with the normal, or the size and shape of the heart in different diseases or in different stages of the same disease.

In the mediastinum new-growths or abscesses may be expected to give evidence in the fluoroscope of their presence by displacing the vessels and changing the normal outlines of the latter before they are large enough to be themselves seen by means of this instrument.

I wish to point out the advantages that may follow a study of carefully made radiographs. I have taken radiographs that indicate, for example, adipose tissue, the outlines of muscles, tendons, and arteries in healthy persons, both children and adults. Possibly we may by this means obtain useful clinical information as to the condition of the arteries in arteriosclerosis before it is recognized in other ways.

Summary.

No harmful effects have been received by the patients—more than five hundred in number—that I have examined with the x-rays.

The varying resistance which the different tissues of the body offer to the passage of the Röntgen rays depends upon the difference in bulk and in chemical composition.

The difference in permeability of air and water by the x-rays is of great importance in thoracic diseases.

The normal brightness of the chest having been observed in the fluoroscope, the departure from the normal in two directions may be noted by comparison. First, a given part of the chest may be darker than normal on account of the obstruction offered to the passage of the rays, which is due to the *increase* of density that occurs in tuberculosis, pneumonia, infarction, œdema, congestion of the lungs, aneurisms, new growths, or to fluid in the pleural and pericardial sacs, that occurs in pleurisy with effusion and pericarditis with effusion; the distribution, location, and amount of this increase in density which the fluoroscope shows, assists us in some cases to distinguish between these diseases or conditions. Second, a given part of the chest may be brighter than normal, because it is *more* permeable than in health by the rays on account of the *diminution* in density, due in the case of emphysema to increase in the amount of air in the lungs, or, in the case of pneumothorax, to increase in the amount of air entering the thorax and displacing the lung.

Importance of the diaphragm lines: The normal diaphragm lines on both sides of the chest (these include position, excursion, and curve of the diaphragm and the clearness with which they are seen) having been observed in the fluoroscope, departure from the normal may be noted by comparison. In tuberculosis and pneumonia the excursion of the diaphragm is restricted, and restricted on the lower side; in emphysema, on the contrary, although the excursion of the diaphragm is restricted, it is restricted on the upper side—the diaphragm may go lower down toward the abdomen—and in pneumothorax on the affected side it has a characteristic curve and moves only on its median end. In tuberculosis, pneumonia, pleurisy, hydrothorax, empyema, and œdema of the lungs, the diaphragm lines, as well as those of the heart, may be wholly or partially obliterated, owing to the abnormal density of the lungs in their lower portion. In some cases of tuberculosis and pneumonia the lessened range of movement of the diaphragm is a more delicate test than the diminished brightness of the lungs. The normal outlines of the diaphragm may also be changed by an abscess or a new growth contiguous to it.

The fluoroscope gives us better assurance that the lungs are in a healthy condition than other methods of physical examination, and, in connection with auscultation and percussion, teaches us in disease to interpret better the signs found by the older method.

The fluoroscope gives us earlier evidence of disease in some cases of tuberculosis and more accurate information of its extent (this affects the prognosis) than can be obtained by the usual physical examination.

The fluoroscope gives us more accurate information of the extent of the disease (this affects the prognosis) in pneumonia and of the duration of an abnormal condition of the lungs.

It shows a displacement of the heart in pleurisy, which is sometimes not recognized by other means, and assists us to recognize and estimate the amount of fluid in the pleural and pericardial sacs.

It enables us to recognize or exclude emphysema.

It enables us to ascertain the cause in some cases of dyspnœa that would otherwise be obscure.

It assists us to recognize œdema of the lungs, pneumothorax, hydrothorax, and pneumohydrothorax.

It gives us the means of making an earlier and more certain diagnosis of some cases of thoracic aneurism than any other method, and enables us in certain cases to exclude it where it has been suspected but is not present.

It enables us to outline the heart more accurately and completely than has hitherto been possible and to observe certain changes in it; and it especially assists us to a more accurate determination of the

size, movement, and position in disease, and in some cases to observe not only the heart as a whole, but the auricle and ventricle separately. Further, it enables us to recognize earlier associated conditions, such as œdema of the lungs, and assists us to recognize pericardial effusion.

We may sometimes make a diagnosis by an x-ray examination alone, in certain cases of aneurism and emphysema, for example, but it is, as a rule, only one method of examination, and its value in assisting us to establish a diagnosis varies, of course, in different diseases. The x-ray examination should be used in connection with other methods; the information derived from it in suitable cases is more definite and accurate than that obtained from auscultation and percussion. The fluoroscope and the stethoscope aid each other.

As is the case with all other observations on which a diagnosis is founded, the conditions which are revealed by the fluoroscope are only to be rightly interpreted after experience in making x-ray examinations has enabled the physician to give these observations their proper weight.

I have had the privilege of studying the physics of the x-rays in the Rogers Laboratory of the Massachusetts Institute of Technology, and I am under obligation to Professor Charles R. Cross and two of his assistants, Mr. C. L. Norton and Mr. R. R. Lawrence, for their aid in this study. I also desire to express my appreciation of the active interest taken by the trustees of the Boston City Hospital in my work, and the kindness of my colleagues on the staff for affording me an opportunity of examining many of their patients.

THE DIAGNOSIS OF EARLY PREGNANCY.

By Thomas Watts Eden, M.D. Edin., M.R.C.P. Lond.,
senior assistant physician chelsea hospital for women, london.

The student of the diseases of women, and equally the general practitioner, must keep the fear of pregnancy ever before him. As a possible occurrence, it cannot be excluded from his mind, except in the case of old women and little girls, the earliest recorded pregnancy being at the age of eight, the latest at sixty-two years. Within these wide age-limits he must be prepared to meet and recognize it under the most unlikely circumstances; prepossessions must never sway his judgment or lead him to dismiss the eventuality from his mind as impossible, if the logic of physical signs points in its direction. In dealing with the diagnosis of pregnancy it is pre-eminently necessary for the medical man to be sure of himself. Circumstances may arise in which he cannot even mention the matter unless certain of his diagnosis, and nothing brings

him so surely to disgrace with his patients as an error here. And further, he must be as certain of its absence as of its presence; for the first step in the diagnosis of many pelvic or abdominal swellings is the exclusion of pregnancy. It is not too much, therefore, to say that an easy familiarity with the signs of pregnancy is an essential condition of success in dealing with the diseases of women. The opportunities of learning these signs are, fortunately, abundant, for I find that among the last 1000 cases that have passed through my hands in the Out-Patient Department of the Chelsea Hospital for Women there were fifty cases of early pregnancy.

Pregnancy may occur either within the uterus—*uterine pregnancy*, or outside it—*ectopic pregnancy;* in very rare cases the two may coexist, or ectopic pregnancy may be double.

Uterine Pregnancy. In the later months the diagnosis of pregnancy in the uterus is usually very simple, consisting of the direct discovery of a fœtus—of the fœtal parts by palpation, and the fœtal heart by auscultation. The diagnosis of early pregnancy, on the other hand, is a deduction from the occurrence of a definite series of symptoms and physical signs. We are only concerned with the methods by which pregnancy may be detected during the first half of the period of gestation. There are two diagnostic points to be considered in every case: 1. The *existence* of pregnancy; 2. Its *duration.*

Symptoms of early pregnancy. It must be clearly understood that pregnancy cannot be diagnosticated from symptoms alone; to attempt this is to invite disaster. Symptoms are useful, first, in offering presumptive evidence of pregnancy, and secondly, in assisting to estimate its duration. A single symptom standing alone is of little importance; thus amenorrhœa may be due to a variety of conditions quite unconnected with pregnancy, but when occurring in a woman previously regular, and associated with morning sickness and bladder irritability, or swelling of the breasts, it forms an important indication that the physical signs of pregnancy must be carefully sought for. Short periods of amenorrhœa occurring in women previously irregular are worthless for diagnosis. Further, in some women a slight periodic loss always occurs in the early months of pregnancy, so that the absence of amenorrhœa is not an absolute contraindication. The date of cessation of the menses is one of the most reliable guides to the duration of pregnancy, and should be noted carefully; the period of onset of the other symptoms is too variable to be of use in this respect. But it must be remembered that conception may ensue directly upon a period of amenorrhœa, as in lactation, and then the size of the uterus fails to correlate the duration of the amenorrhœa. On the other hand, if menstruation occurs during the first two or three months of pregnancy, the uterus may be found up to the umbilicus after two missed periods. The long lists of the consti-

tutional and symptomatic changes of pregnancy described in text-books of obstetrics need not be considered here, for their practical value is *nil.*

From these considerations it is sufficiently obvious that the symptoms of early pregnancy are too uncertain to offer any reliable basis of diagnosis.

Physical signs of early pregnancy. These are *external* and *internal;* the external are *mammary* and *abdominal;* the internal are *vaginal* and *uterine.*

Mammary signs. These are of prime importance in a first pregnancy; of minor importance in women who have had recent miscarriages or who have never suckled their children, or in whom several years have elapsed since the last pregnancy; and worthless in women more recently pregnant than this. In a nullipara it is often possible to detect a distinct hypertrophy of some of the lobules of the gland as early as the beginning of the second month; these portions are usually situated peripherally, and are firmer and more tender than the surrounding parts. Toward the end of the second month it is possible to express a little clear serum from the nipple by squeezing the gland between the thumb and finger. The nipple signs, such as pigmentation, erection, the formation of the secondary areola, and the enlargement of Montgomery's tubercles, appear a little later. They become permanent after suckling, and their presence is, therefore, of no diagnostic value in women who have already borne and suckled children. Purple striæ and enlarged subcutaneous veins are not found in the early months of pregnancy.

Abdominal signs. The skin changes are inconclusive. The linea nigra is often found in virgins of dark complexion, and is often absent in pregnant *blondes.* Recent striæ, which are pale-purplish in color, are seldom seen until a period when other signs suffice for the diagnosis; they can hardly be confused with old striæ, which are white and shrivelled. The latter are often found in women in whom the abdomen has been distended by tumors or fluid accumulations in the peritoneum.

The gravid womb can usually be palpated from the abdomen at the end of the third month. In a multipara it can very frequently be felt through the lax abdominal walls at an even earlier period, by dipping the hand down into the pelvis. In a primipara much depends upon the degree of resistance of the abdominal wall. The feeling of a gravid womb is a sensation *sui generis,* and once learned is seldom mistaken; special pains should, therefore, be taken with this part of the examination.

The patient should be lying with the abdomen entirely exposed, the shoulders supported by a pillow and the knees bent; in this position the maximum relaxation of the abdominal wall is obtained. If the wall is lax one hand should be placed above the pubis, and the ulnar margin depressed toward the spinal column, so as to reach behind the uterus;

the fundus then fits into the hollow of the palm, and may be grasped between the fingers and thumb. If the wall is resistant both hands must be used, the points of the fingers being pressed down on each side of the uterus, which is thus grasped between them. In this way the presence of a mesial, or slightly lateral, rounded swelling can be definitely made out; its consistence is best described as soft and plastic; it is movable in a lateral plane and not tender. It differs from cysts or circumscribed fluid accumulations, in the absence of tension and of the fluid thrill. Further, if palpation be prolonged for some minutes, and especially if the swelling be gently rubbed with the hand, its consistence will be felt to undergo gradual rhythmical alterations, becoming alternately softer and harder. The change is not extreme, and care and practice are required for its detection; but with a little experience it can generally be obtained in a gravid womb large enough to be felt above the pelvic brim. It is not absolutely pathognomonic of pregnancy, for it is sometimes observed in cases of uterine fibromyomata, but it does serve absolutely to exclude swellings of extra-uterine origin. On auscultation, the uterine souffle will be heard at the sides of the uterus on pressing deeply with the stethoscope.

It will thus be seen that under favorable circumstances pregnancy may be diagnosticated by symptoms and external signs alone if it have advanced beyond the end of the third month. The most favorable circumstances are, that the patient be a nullipara, and the breast signs, therefore available; and that there be no undue difficulty in the abdominal examination. But the converse by no means holds good, viz., that the absence of these signs is sufficient to exclude pregnancy. The gravid uterus may be inaccessible from the abdomen at the end of the third month, because it is retroverted; or the ovum may have perished, in which case the size of the uterus does not correspond to the duration of the amenorrhœa, and the breast changes generally recede. It is a useful clinical rule that pregnancy can never be excluded except by the bimanual examination. Further, we are often called upon to diagnosticate pregnancy before the gravid womb is accessible to external examination, and then the bimanual is imperative; and in the great majority of cases of early pregnancy its employment is necessary because the external signs are inconclusive. In any case it is better to examine internally than to run the risk of error.

Vaginal signs. Blue discoloration (Jacquemier's test) I have never seen earlier than the third month. It consists of a deep, dull purpling of the vaginal mucosa, and is, of course, due to venous congestion from pressure upon the pampiniform plexus, and is not pathognomonic of pregnancy. It is more marked usually in multiparæ than in nulliparæ, and appears first upon the anterior or posterior walls immediately within the carunculæ or hymen. Within the canal the walls feel lax and soft, and

pulsation may often be felt in the lateral vaginal arteries. The vaginal signs are not marked until a period at which the uterine signs are generally conclusive; their diagnostic value is, therefore, subsidiary, but in difficult cases they afford valuable confirmatory evidence.

Cervical signs. These are of more importance than the vaginal signs. Softening of the cervix may be distinct as early as the middle of the second month (sixth week). It first affects the lips of the os externum, and may then be confused by the tyro with the velvety feel of the condition known as "erosion;" but the speculum will always serve to distinguish this. Later the whole extent and thickness of the cervix becomes soft and succulent, forming one of the most striking of the physical changes in pregnancy; but this is seldom found before the mid-term, when its diagnostic value is subsidiary to the changes in the body of the uterus. The early stages of softening, however, form a very important diagnostic sign, and it is always worth while to pay careful attention to the condition of the cervix. The absence of softening, especially in a multipara, has not the same negative value, however, for an unhealthy, indurated cervix softens much more tardily than a healthy one. Purpling of the vaginal portion of the cervix is met with rather earlier than the same change in the vagina; it is due to the same cause, and is not absolutely characteristic of pregnancy. But cervical softening, when distinct, is almost as pathognomonic as the fœtal heart, although it is found equally in uterine and extra-uterine pregnancy.

Uterine signs. The changes in the uterus in early pregnancy are, briefly, *enlargement* with *distention;* the former is due to general hypertrophy of the organ; the latter to the presence within it of a bag of fluid containing a mobile, solid body—the fœtus. The shape of the uterus is determined partly by the hypertrophy and partly by the distention; the general pear-shaped contour is preserved; but while the empty uterus is flattened, the gravid uterus is bulging, the fundus feeling almost spherical. The consistence of the uterus is determined partly by the muscular character of its walls, and partly by the bag of fluid within. The muscle is hypertrophied and undergoes rhythmical contractions, hence the rhythmical changes in consistence which occur. The fluid within lends it softness and plasticity, while the free solid body may be made to impinge upon different spots of the wall, delivering blows which can be felt by the fingers (*ballottement*).

Under favorable circumstances the uterine changes can be made out as early as the end of the second month (seventh to eighth week). At this period the ovum measures two inches by one and one-half inches, and in the great majority of cases is situated at the fundus. The uterus is considerably lengthened, and an empty space remains between the lower pole of the ovum and the os internum. The fundal portion, however, is completely filled by the ovum, and is converted from a

potential cavity into a globular space with a diameter of about one and one-half inches. The normal anteversion of the uterus is usually somewhat exaggerated, and, given a lax abdominal wall, there is little difficulty in palpating the uterus with exactness. A certain acquaintance with the size and consistence of the non-gravid womb is, of course, essential, but the rounded, bulging outlines of the early gravid womb are so striking that a *tactus eruditus* is hardly necessary for their detection. The distended uterine fundus can be taken between the hands and its peculiar soft and yielding existence made out; but at this stage rhythmic contractions cannot be felt, the fœtus is too small and light to give *ballottement*, and the amount of liquor amnii too small to yield fluctuations through the many intervening layers of tissue. An attempt should next be made to palpate the empty lower pole of the uterus between the two hands. The internal fingers are placed immediately in front of the cervix, and the external fingers passed down the posterior surface of the uterus, and then directed to meet them, so as to grasp the lower part of the body of the uterus between the two hands. The fingers can be made to meet at this point through the soft walls with surprising ease, but it is necessary to remember that even in the non-gravid womb the tissues are thinnest here. But in pregnancy the contrast between the bulging upper pole and the flaccid, empty lower pole is so distinct as to constitute a valuable sign of pregnancy, which is known by the name of its introducer as Hegar's sign. To obtain this sign it is essential, first, that the abdominal walls be lax, and the vagina fairly roomy; and second, that pregnancy be not advanced beyond the end of the third month, when the uterus becomes too large to be thus handled, and the ovum has practically filled up the whole of the uterine cavity.

A month later (twelfth to thirteenth week), the uterus has increased very considerably in size, and can often be palpated from the abdomen. Bimanually it feels globular and as large as a Jaffa orange. A new sign is now apparent, namely, muscular contractions in the wall of the uterus. These are of two kinds, the rhythmic and the irregular. Rhythmic contractions show themselves in a gradual variation in consistence of the whole of the uterus, which becomes alternately harder and softer under the hands, if the examination be made in a leisurely manner. Often the contractions are so feeble that they only serve to render the outline of the uterus more distinct. They are, of course, produced by waves of contraction affecting the uterine muscle. A little care and experience are required for the appreciation of this sign, as the change in consistence is never very marked at this early period. The irregular contractions are much more easily detected, and form one of the most useful diagnostic points of a gravid uterus between the third and fourth months. They consist in tetanic contractions affecting localized areas of the uterine muscle, while the greater part

of the wall is unaltered. Their effect is to make the uterus feel irregular, both in shape and in consistence. Thus the greater part of the uterus may feel soft and cystic, while one or other cornu is occupied by a hard lump which may be regarded as a fibroid on first examination; or one lateral half may be hard and firmly contracted, and the other half soft and bulging; or there may be a mesial band of contraction hollowing out the fundus and anterior wall, while the sides are soft and unaltered. These contractions are not intermittent, but on a second examination, a few days later, the uterus may be found to be in every respect symmetrical, or to have assumed some new deformity. Before I learned the significance of these changes in the pregnant uterus I had rashly diagnosticated fibroids in various parts, and even tubo-uterine pregnancy, only to find myself on subsequent examination confronted with a typical normal pregnant uterus. This sign, which was first pointed out by Ahlfeld, is well known and appreciated in Germany, but receives little attention from British teachers.

The only other sign of importance in the early gravid uterus is *ballottement*. This is not of great practical use, from the fact that one so frequently fails to obtain it in an undoubted case of pregnancy. To obtain ballottement easily, examination must be made with the patient in the erect position, a proceeding quite at variance with our accepted notions of propriety. With the patient lying on her back, the fœtus tends to fall toward the posterior uterine wall, which is difficult of access, hence the frequency with which the sign is absent in ordinary examination. At times, however, one succeeds in obtaining it, and I have found the following the most useful method: With the abdominal hand the uterus is pressed firmly down into the pelvis; then the vaginal fingers administer a quick, gentle jerk to the anterior uterine wall, which tosses the fœtus upward through the liquor amnii, supposing it to have been resting at that part of the uterus; this may be answered in a moment by a gentle tap representing the fall of the fœtus, but more often it is not. Sometimes with the fingers behind the cervix, or in the rectum, the tap may be felt, when one fails to get it through the anterior fornix. But it is not worth while to spend much time in the effort, although the positive value of the signs is, of course, considerable. I have, however, felt ballottement through the anterior fornix in a case of tubercular peritonitis, where it was shown by subsequent operation that the tap came from the ovary, which could be tossed up through the encysted fluid by pressure from below.

It may be useful to tabulate the physical signs of early pregnancy in the order of their occurrence.

End of second month (eight weeks):

Breast signs (important only in first pregnancy).

Softening of cervix.

Distention of fundus.
Hegar's sign.

End of third month (twelve weeks):
Breast signs (important only in first pregnancy).
Bluing of vaginal walls and cervix.
Softening of vaginal walls and cervix.
Uterus size of large orange.
Hegar's sign.
Uterine contractions.

End of fourth month (sixteen weeks):
Breast signs (important only in first pregnancy).
A supra-pubic swelling.
Uterus size of fœtal head.
Uterine contractions.
Ballottement.
Vaginal and cervical bluing and softening.

Ectopic Pregnancy. Ectopic pregnancy has become such a fruitful field for the abdominal surgeon, that we are, perhaps, apt to lose sight of the fact that it is, after all, but a physiological accident, liable to befall any healthy woman during the fruitful period of life. For reasons which are at present obscure, the fertilized ovum becomes in some cases implanted upon some part of the Fallopian tube instead of upon the uterus, but there is no evidence to prove that diseased conditions of either uterus or tubes play any part in its occurrence. Nevertheless it is one of the most perilous accidents to which child-bearing women are subject, and as experience has shown its early recognition to be quite practicable, it devolves upon every practitioner to place himself *au courant* with the principles and methods of its diagnosis. Its consideration along with uterine pregnancy is justified by their physiological relations, and by the fact, surprising as it may seem, that the differential diagnosis of the two is often a matter of very considerable difficulty.

It is not possible by clinical methods to determine the exact site of an ectopic ovum; all the anatomical varieties of tubal pregnancy may, therefore, be classed together here, and with them must be associated the rare condition in which pregnancy occurs in a rudimentary horn of a bicornate uterus. The occurrence of ovarian or primary abdominal pregnancy is open to the gravest doubt.

Symptoms of ectopic pregnancy. These are somewhat less equivocal than the symptoms of early uterine pregnancy. In a large proportion of cases the patient has been sterile for many years, although this is by no means always the case. The menstrual function is for a time in abeyance, and then is succeeded by irregular or persistent hemorrhage. It is rare for more than two periods to be missed; after this comes hemorrhage, variable in amount, generally accompanied by considerable

pain, and sometimes by the discharge of a fleshy mass from the uterus —the decidual cast. In addition we find the patient usually complains of morning sickness, and perhaps of swelling and tenderness of the breasts. The symptomatology thus far is closely suggestive of an early abortion, and in point of fact many cases which come under notice at this period are thus mistaken, especially when the mass discharged from the uterus has not been seen by the medical man. As a rule, however, the abdominal pain precedes the hemorrhage by a week or two, or even longer, and persists or grows more intense after the occurrence of the supposed abortion. This should put us at once on our guard. Further, between the second and third months an occurrence is very frequent, which gives rise to definite and obtrusive symptoms, viz., rupture, partial or complete, of the gestation sac. This accident may be spontaneous, but more often it ensues upon slight exertion, such as stooping, or straining at stool. It is characterized by sudden pain and shock; the pain is abdominal, but not specially localized; the degree of shock is very variable, it may be merely a slight feeling of faintness, with nausea or vomiting; on the other hand, it may be prolonged and protracted, as in cases attended with profuse internal hemorrhage. Cases of the latter class pass at once into the hands of the medical man, and have to be carefully differentiated from such conditions as perforation of a gastric ulcer, perforating appendicitis, acute intestinal obstruction, etc. Cases of the former class very frequently do not seek immediate advice, and the history of the occurrence has to be extracted from them after the lapse of some weeks or even months. When obtained, however, such a history is a very important diagnostic point in these cases. The latter history of cases of partial rupture is usually one of progressive and increasing illness; sometimes the sac suppurates; in rare cases absorption occurs, and the patient gradually recovers; more rarely still gestation goes on to term, when the fœtus perishes unless rescued by surgical interference.

Physical signs of ectopic pregnancy. As in uterine pregnancy, the ultimate diagnosis must rest upon physical signs—*i. e.*, upon the discovery, by the bimanual examination, of an ectopic gestation sac, or, more accurately, of a swelling outside the uterus, which may be presumed to be a gestation sac. The changes in the breast, vagina, and cervix uteri occur in this condition very much as described in uterine pregnancy; the changes in the body of the uterus are, however, different, because it does not contain the ovum. In addition there is the presence of an extra-uterine swelling.

We have only to consider the physical signs of early ectopic pregnancy; they differ considerably before and after rupture.

Physical signs before rupture. In the great majority of cases rupture occurs during the third month (eighth to twelfth week); it is, therefore,

very exceptional to find an unruptured tubal pregnancy which has advanced beyond the third month. The bimanual examination is usually fairly easy, and reveals changes in the pelvic organs so marked that they cannot be missed. On one or other side of the uterus is found an oval or globular, tender swelling, of soft and plastic consistence, and crossed below by one or more pulsating vessels. It is usually slightly movable in a vertical plane, but immobile laterally. Its size is subject to great variation, being dependent upon two conditions, viz., the stage of development of the ovum and the amount of effused blood in the tube. The latter is the more important factor, for the ovum almost always perishes about this period, and rupture is due, not to the growth of the ovum, but to the distention of the tube by hemorrhage. There is, therefore, not the same regular increase in size of a tubal gestation sac as we find in a gravid uterus. The tube, however, seldom becomes larger than a tangerine orange without bursting under the strain. The muscular element in the walls of the sac is too feeble to give rise to the contractions which form an important sign of a gravid uterus. When the ovum occupies the outer end or ampulla of the tube, the inner empty part of the tube may sometimes be palpated between the sac and the uterine border, and may be traced from one to the other, proving the swelling to be tubal in origin. The ovary cannot, as a rule, be distinguished from the gestation sac.

The uterus is displaced by the swelling to the opposite side of the pelvis; it is enlarged and softened, but the fundus is flaccid and empty, and feels quite different from an early gravid womb. Its mobility is unimpaired except for the presence of the lateral swelling. The opposite appendages may often be clearly felt to be unaltered; they may, however, feel swollen and tender. There is rarely difficulty before rupture in distinguishing the uterus from the gestation sac, but I have once or twice been deceived by the irregular contractions in the gravid uterus, described on a previous page. The sound is usually to be avoided as a method of differentiating uterine from ectopic gestation.

The differential diagnosis before rupture is generally limited to one condition, viz., suppurative inflammation of the appendages. The physical signs do not absolutely suffice to distinguish them, nor do the symptoms. In pyosalpinx there is usually a prolonged history of abdominal pain and general illness, but the condition may supervene rapidly upon a miscarriage, and then the history closely simulates that of ectopic pregnancy, in which a decidual cast has been expelled from the uterus. The temperature is useless as a guide, for in ectopic pregnancy there may be considerable pyrexia of irregular type, running up to 103°, while a pyosalpinx is not always attended by fever. The menstrual history is the safest symptom to rely upon, for definite periods of six to eight weeks' amenorrhœa very rarely occur in suppurative inflammation

of the appendages. With regard to physical signs, a pyosalpinx is usually accompanied by a much greater degree of surrounding inflammatory changes than a gestation sac; it therefore tends to form a fixed swelling, harder in consistence, and much less definite in outline. The uterus, although enlarged, is usually hard and its mobility greatly impaired, and the opposite appendages may be also obviously diseased. The discharge of a decidual cast, when carefully determined by the microscopic examination of the discharged tissue, is very important evidence of ectopic pregnancy, although even this sign is not pathognomonic, as was once supposed.

Physical signs after rupture. Rupture may occur in the following different ways:

1. Intra-peritoneal rupture.
   (*a*) Leading to sudden and profuse hemorrhage, endangering life.
   (*b*) Leading to slow, progressive hemorrhage and the formation of a pelvic hæmatocele.
2. Broad ligament rupture.
   (*a*) In rare cases leading to profuse hemorrhage, endangering life.
   (*b*) More often progressive, forming a pelvic hæmatoma.

The cases in each division attended by profuse bleeding give rise to the constitutional signs of concealed hemorrhage, and are submitted to immediate operation. I have seen only one case of this kind in which the rupture was extra-peritoneal, but here an enormous swelling developed within a few days, extending above the umbilicus, and filling the whole pelvic cavity. Operation proved the blood to be entirely contained between the layers of the broad ligament. Profuse bleeding from intra-peritoneal rupture is much more common.

The differential diagnosis of cases (*b*) in each division is a matter of some importance, but is often attended with great difficulty, which may become insuperable when a broad ligament sac ruptures later on into the peritoneal cavity. This event is known as secondary intra-peritoneal rupture. When the amount of effused blood is considerable the gestation sac becomes obscured, and the physical signs tend to resolve themselves into those of pelvic hæmatocele and pelvic hæmatoma respectively. Blood effused slowly into the peritoneal cavity tends, of course, to accumulate in the pouch of Douglas, forming a retro-uterine swelling; while blood effused into the broad ligament distends that structure, forming a swelling lateral to the uterus. But lateral displacement of the uterus may have occurred before intra-peritoneal rupture took place, and then the condition will closely simulate a hæmatoma. Further, blood in the broad ligament tends to raise the peritoneum over the whole pelvic floor, and thus creeps along behind the uterus, surrounding the rectum, and even extending over to the opposite side. In this way a hæmatoma may simulate a hæmatocele.

The changes which occur in the effused blood form an important guide. Intra-peritoneal blood undergoes clotting in parts, while other parts remain fluid; the mass thus varies in consistence in different parts, the fluid parts feeling soft and boggy, and the clotted parts harder and more solid. A hæmatoma is more regular in consistence from the absence of this irregular clotting; it feels also much firmer and more solid than the hæmatocele, owing to the pressure to which it is subjected by the limiting layers of tissue. Rectal examination often aids in determining the consistence of these swellings, and may also show a ring of effusion around the rectum high up, a condition strongly favoring the diagnosis of an hæmatoma.

The importance of distinguishing between the intra-peritoneal and the extra-peritoneal forms of rupture lies in the fact that in the latter it is often possible to leave the case to nature, and trust to the occurrence of absorption of the swelling; in the case of intra-peritoneal rupture, however, it is always better to operate without delay, owing to the grave risks of recurrence of the hemorrhage, which may at any time become profuse and place the patient's life in peril. But often the matter remains in doubt, and the question of interference must be decided upon other grounds.

In most cases of ruptured ectopic pregnancy, and in some cases before rupture, when the gestation sac is of large size, it is a matter of great difficulty to determine the position of the uterus and its relation to the swelling in the pelvis. In the absence of definite proof of the position of the uterus, the differential diagnosis from a retroverted and an incarcerated gravid uterus often becomes a matter of the greatest difficulty. Yet the practical importance of a correct diagnosis is very great, for the treatment of the latter condition is not abdominal section, but evacuation of the uterus. Examination under an anæsthetic is often a great help in clearing up the matter, by enabling the examiner to determine the size and position of the uterus by the bimanual method. In the present instance there need be less hesitation in using the sound, because if the case be ectopic no harm can result, while if it be uterine, the proper treatment is the induction of abortion, and the passage of the sound is, therefore, not only a diagnostic but an appropriate operative procedure.

REVIEWS.

A HANDBOOK OF MEDICAL CLIMATOLOGY. By S. EDWIN SOLLY, M.D., M.R.C.S, late President of the American Climatological Association. 8vo. pp. 470. Philadelphia and New York: Lea Brothers & Co., 1897.

THE American medical profession has been slow to recognize the natural advantages which the United States offers for the therapeutic use of its climate. Although Americans are justly said by Europeans to be constant travellers, they often know less of their own country than of Europe. Of late years, however, as internal medicine has become more exact and modern therapeutics has come to embrace every agency for the cure of disease, the climate of the United States has been utilized not only by American travellers, but also by American invalids. There has been wanting a book which prescribes properly the climate of this country with reference to its fitness for the treatment of disease. Weber has given us his excellent handbook of European resorts, but it remained for Solly to be the first American author to supply the needed volume.

The book naturally begins with a brief statement defining medical climatology, and showing the difficulties which such an author has experienced from lack of accurate meteorological data. While the United States Weather Bureau does its utmost, its support is so scanty that it fails in many respects. This is especially true in the lack of humidity observations, and, as the degree of dampness is a vital factor in a given climate, this lack is very serious.

The principles of medical climatology are clearly set forth, and earth, air, water, light, and electricity each receives consideration as factors in a climate. Next follows the physiology of climate, and then its ethnology. The geographical distribution of disease, embracing the civilized world, naturally prepares the way for a classification of climate. A table is given of the principal stations from various portions of the United States, showing summer and winter temperatures and their differences. This concludes the author's very clear and interesting account of the principles of medical climatology.

Section II. is devoted to the influence of climate upon disease, and here, naturally, phthisis first receives extensive consideration. A distinction is made between phthisis and tuberculosis, and the effect of the various elements of climate upon the disease is carefully considered. It is shown that phthisis is most common where the air is impure, experiments having demonstrated that animals inoculated with tubercle bacilli successfully resist if kept in pure air, while others similarly poisoned and kept in close quarters die. Attention is called to the importance of direct sunlight in destroying bacilli. Humidity is shown to be a most powerful factor for evil with the phthisical.

Dryness of air is quite as potent for good as humidity is for evil.

Contrary to a common belief, severe and sudden changes of temperature, provided the air be dry, not only are not injurious, but are beneficial to the phthisical. It is interesting to observe that neglect of sanitary precautions and unhealthy occupations can neutralize the advantages of a favorable climate. Changes of temperature, with moisture, and dampness of soil are proverbially injurious. As Weber remarked, cold is not injurious, nor warmth curative, in phthisis. Equable climates are not necessarily best; but pure air is absolutely essential. It is interesting to note the good effects of a pure atmosphere considerably below the sea-level, which is virtually the use of compressed air on a large scale.

The author next considers the effect of altitude, and shows by tables the diminution in death-rate in higher parts of the world. It is hard to estimate the least altitude which is of benefit to the phthisical, but probably a change of 1500 feet may prove of value. The effect of altitude upon the phthisical is explained by physiological changes. The reduction of oxygen pressure causes the patient to breathe more rapidly, expanding the chest, increasing the action and size of the heart, and also the amount of red blood-corpuscles and hæmoglobin, enhancing the oxygen-absorbing power of the blood in definite ratio to the elevation. From these considerations the general conclusions are drawn that high altitudes have climates favorable for anæmic patients, or those suffering from any other deficiency of the blood; while in chronic germ diseases the improved state of the blood in these cases is of great value, providing the accompanying conditions are not of a nature to be seriously aggravated by altitude. While experiments have not positively demonstrated an increase in the germicidal power of the blood in those inhabiting high regions, clinical observation leads us to believe in its existence. The increased sunlight and sunheat, with electric tension and increased ozone, act practically as efficient germicides to prevent the spread of tuberculous infection.

The author divides phthisis as influenced by climate into tuberculous, pneumonic, and catarrhal. Tuberculous patients do best in most cases in cool, dry climate, and less often in warm, dry climate. Patients of the pneumonic type are in danger in cool, dry air of over-stimulation of the lungs, and hence a warm moist climate as a sedative is better. Catarrhal cases thrive in warm, dry air, which lessens the secretion and acts as a stimulant.

The author devotes attention to the individual and his peculiarities. He divides patients into the wise and unwise, and urges that it is not the consultant, but he who sees the patient repeatedly, who can judge him best. He urges a careful study of the patient's temperament, and presents a table which shows the relative value of temperament as influencing recovery. Naturally enough, a strong physique, irrespective of temperament, is most valuable The phlegmatic do better than the nervous, provided that each is strong. If physique be poor the nervous patient does better. The writer found that 61 per cent. of patients were wise in caring for themselves, and 39 per cent. were foolish. We are interested to learn further that persons of phlegmatic temperament and strong physique are most apt to show wisdom. The doctrine of rewards and punishments is exemplified in statistics which show that one-third more of the wise are cured above the average of mankind, and four times as many as among the foolish. This Book of Climatological Proverbs closes with the sage conclusion that the essentials of the

general treatment of phthisis are to preserve and strengthen the physique, enforce prudence, and induce placidity. We are glad to know that at least among the phthisical the modern philosophical tenet is not true—"Be good, and you'll be lonesome."

The writer goes into a careful consideration of the results of the treatment of phthisis by change of climate. Here, again, high altitudes bear the palm. The results of various writers the world over are carefully tabulated to show this fact. In comparison with sea climates, it is shown that the phthisical do better the further they are removed from the sea and in high altitude. As regards the use of tuberculin, Trudeau has found it of service only where the patient could tolerate without fever a gradual increase in dosage. Solly's belief is that the moderate use of tuberculin does not materially influence phthisis. There can be, however, no reasonable doubt of the value of sanitarium treatment. It is greatly to be regretted that the well-to-do resort to it so unwillingly, and that there are so few free beds in sanitariums for the poor.

The author urges the danger which attends improvement in the first stages of phthisis. The patient is often deceived into returning to his former home, only to relapse fatally. It is interesting to note that in 52 per cent. of cases diagnosis and treatment were too late for marked improvement, the average delay being two years. The serious consequence of this negligence is shown in the fact that 62 per cent. of first-stage cases were benefited, and but 15 per cent. later. The author concludes this portion of the book by a timely plea for care in the selection of the cases to be sent away from home, and surely the practical experience of the profession, and the many sad disappointments which occur in badly chosen cases, must emphasize the truth of his statement.

We have dwelt thus upon the first portion of the book because of its wide general interest. Other forms of disease are next considered, and the influence of climate upon them. Due caution is urged that patients recovering from pneumonia are not sent suddenly to an altitude and allowed to exercise upon arrival. In asthma barometric pressure is the important element, and must be decidedly increased or decreased to produce a result. In hay-fever the patient must avoid the pollen or dust which excites it. In diseases of the heart high altitude excites and disturbs an irritable heart, even when not diseased. In diseases of the kidney altitude tends to aggravate acute nephritis, and to hold in check chronic nephritis. Solly prefers a warm, low inland climate for chronic renal disease, and especially such surroundings as tend to promote a healthful action of the liver. Altitude does not prevent rheumatism, but aggravates it. Cold and damp are especially injurious.

The limitations of space forbid us from commenting in detail upon the remainder of this book. One hundred and eighty-eight pages are devoted to North and South America, and a reader who is not familiar with the United States will be surprised at the wealth of its climatological resources. Excellent maps, some of them in relief, and abundant tables fully illustrate this portion of the book. The climates of the various resorts of Europe also receive consideration, while the resorts of Africa, Asia, and Australasia are described. The island climates most resorted to are described in concluding the volume. Meteorological tables are appended.

In concluding our review of this volume, we congratulate the profes-

sion of America upon the acquisition of an interesting, reliable, and valuable treatise on climatology. It should enable the profession to act intelligently in the important choice of residence for invalids, and greatly increase the number of cures in patients whose diseases can be favorably affected by climate. E. P. D.

REFERENCE BOOK OF PRACTICAL THERAPEUTICS. By Various Authors. Edited by FRANK P. FOSTER, M.D., Editor of the *New York Medical Journal* and of Foster's *Encylopædic Medical Dictionary*. Vol. II. [N to Zymoidin]. Pp. 618. New York: D. Appleton & Company, 1897.

THE second and concluding volume of this work has appeared with commendable promptness, and, like the first, shows the painstaking labor of the editor. The sections devoted to serum-treatment (p. 166), thyreoid treatment (p. 287), and mineral waters (p. 362) are exceptionally good. Usually the information is complete and so far advanced as is possible when delays incident to presswork are taken into consideration. As an exception to this statement may be cited that concerning nuclein (p. 19) and strophanthus (p. 230). In the matter upon rhus (p. 131) we find no mention of Pfaff, whose work is quite as important as any which has been done. Of minor errors we find fewer than would have been anticipated in a work of this character. The following is curious (p. 11): "Nitroglycerin is sometimes erroneously regarded as a nitrite. It is a trinitrite of glyceryl." Its correct chemical name, however, is found under nitroglycerin (p. 14). The binder is probably responsible for the cover-title reading "N–X-rays." As a matter of fact, X-rays are noticed on p. 397 and also at the end of the appendix, which is composed of omitted and additional matter. The references are usually to journals, giving year, month, and sometimes date. If their insertion is intended to facilitate reference to original articles, the year, number, and page, as given in the *Index Medicus*, would have been much more satisfactory. The general index, double columns, extending from pages 459 to 544, adds greatly to the value of the work. That of diseases and remedies, from pages 545 to 613, is valuable to the thorough student, but encourages the lazy practitioner, who regards the name of a disease as a peg upon which to hang a prescription. The index of authors (pp. 614 to 618) is hardly satisfactory. For example: On reading the section devoted to toxins there is no indication as to the author quoted until we find a reference "to my most recent paper in THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES for September and October, 1896." We recall at once that the author is Coley, but the "List of Authors" does not contain his name. We turn to our files and find that the article in question is contained in the September and not the October number of this JOURNAL. We continue our reading, and the brackets are unnecessary, for we recognize the editor's concise words, finding clearly stated the important views which have been presented. At the end, closely following the editor's work, we note the name of the contributor, which is Coley. A contributor using his own material to fill up his copy should know where

it appeared; nor should he expect an editor to furnish not only a larger amount of material, but also the results of more extensive research in current literature. We call attention to this not because we do not appreciate the excellent work of the contributor, but in connection with the wish, which we expressed in the review of the first volume, that the editor had contributed more extensively to it. The favorable opinion of the first volume which we expressed applies equally to this, which has maintained the high standard with which this work was begun.

R. W. W.

DISEASES OF THE GALL-BLADDER AND BILE-DUCTS. By A. W. MAYO ROBSON, F.R.C.S., Hunterian Professor of Surgery and Pathology, Royal College of Surgeons of England. Pp. 150. New York: William Wood & Co., 1897.

THIS monograph is a reproduction of the Hunterian Lectures before the Royal College of Surgeons in 1897, and embodies the result of Mr. Robson's experience in hepatic surgery during many years of practice. An appendix is added giving in a tabulated form the details of 170 consecutive operations on the gall-bladder and bile-ducts.

The discussion of the topic selected by the author is conducted in a clinical rather than a pathological manner. It is exceedingly valuable as a contribution to clinical surgery. Its worth would be greater if more attention had been given to the pathology of the conditions described. A great many specimens from the English museums have been examined by Mr. Robson, and of a good many of them photographic illustrations are given. The work of American surgeons in this branch of operative work has been well recognized, and many cases are cited from American literature. The many practical points contained in the book will render it a valuable one to those working in abdominal surgery.

The author is disposed to treat diseases of the gall-bladder and bile-ducts in a radical manner. Among his other propositions are two which are worth mentioning in this short review: The first is that obstinate catarrh of the gall-bladder should be treated as the similar condition of the urinary bladder,—by medical and general remedies for a moderate length of time, and, in the event of these failing to produce cure, the establishment of physiological rest of the organ by drainage. This is to be accomplished by the performance of cholecystotomy. The second proposition concerns phlegmonous cholecystitis. He here advises incision and drainage, which necessitates, therefore, an exploratory incision as soon as the diagnosis is made. If, however, gangrene is found to be present, the gall-bladder is to be removed, just as in gangrenous appendicitis the appendix is excised.

Such surgical activity is in accord with the results of modern thought; and though some may think these conclusions a little radical, they are probably those which are entertained by surgeons who have had the most experience in abdominal surgery. The volume should be in the hands of physicians as well as surgeons; since many of both classes do not realize the necessity for prompt surgical interference in these pathological conditions of the bile-tracts.

J. B. R.

TRAITEMENT DE LA BLENNORRHAGIE. Par E. DELEFOSSE, M.D. Pp. 261. Paris: Caccoz, 1897.

TREATMENT OF GONORRHŒA. By E. DELEFOSSE, M.D.

THIS very convenient little book presents the treatment of this disease as it occurs in both man and woman. It is thoroughly illustrated—almost unnecessarily so when an illustration of a storage-battery as a source of light for endoscopy is introduced. It is well advanced as to our present therapeutic knowledge, save that the statements on the newer silver salts are made by quotation and not from personal experience. In this connection Knowles Swinburne will doubtless be surprised at appearing as Kmowleo (p. 114). The author appears to have considerable faith in the abortive treatment for men. Of especial importance is his insistence upon the use of the endoscope and the unfortunate effects of this disease as it occurs in women. Although but forty pages are devoted to the latter subject, there is no doubt as to the importance which the author considers it to have. As an appendix we find an excellent formulary of the newer additions to our therapeutic resources. We are of the opinion that this is a concise, practical, and safe presentment of the present status of the treatment of gonorrhœa.

R. W. W.

PRAXIS DER HARNANALYSE. ANLEITUNG ZUR CHEMISCHEN UNTERSUCHUNG DES HARNS, NEBST EINEM ANHANG: ANALYSE DES MAGENINHALTES. By DR. LASSAR-COHN, Universitätsprofessor zu Königsberg i. Pr. Pp. 38. Hamburg und Leipzig: Verlag von Leopold Voss, 1897.

ANALYSIS OF URINE AND STOMACH CONTENTS. By LASSAR-COHN.

THE little work before us is certainly most commendable. The writer draws attention to the prevailing opinion among physicians that even the simplest tests in the chemical examination of the urine and the gastric juice require an intimate knowledge of chemical manipulations, such as can only be obtained after a prolonged period of study. He shows that this view is untenable, and very justly maintains that with but little attention the physician will be enabled to test intelligently for the presence of all of the more important chemical constituents of the urine and the gastric juice, and that his results will be entirely reliable if he strictly adheres to standard methods, such as those described in this little work. The tests for albumin, sugar, acetone, diacetic acid, bile-pigments, urobilin, blood, indican, and the conjugate sulphates, as well as the methods for the quantitative estimation of albumin, sugar, and the conjugate sulphates, are considered in detail. In the second portion of the work the tests for hydrochloric acid, lactic acid, and the volatile fatty acids are further described. Most valuable are the instructions given for the artificial preparation of abnormal urines, a feature which is new in text-books on Urinary Analysis, and which in itself renders the booklet valuable to both teacher and student. We are also glad to see that the old test of Uffelmann for lactic acid has been discarded. In Germany the work should be especially valuable to chemists and druggists, to whom physicians resort for such examinations. Clinical data are practically omitted. The statement on page 19, that conjugate sulphates can scarcely occur in the urine after a thorough cleansing of the intestinal tract, requires some modification.

C. E. S.

PROGRESS

OF

MEDICAL SCIENCE.

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD W. WILCOX, M.D., LL.D.,

PROFESSOR OF MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL.

The Treatment of Insomnia.—The most important discussion, from the therapeutic stand-point, at the Montreal meeting of the British Medical Association was upon this subject.

DR. C. K. CLARKE adopts Sée's classification of insomnia: as (1) dolorous; (2) digestive; (3) cardiac and dyspnœal; (4) cerebro-spinal and neurotic; (5) psychic; (6) of physical fatigue; (7) genito-urinary; (8) febrile and autotoxic; and, finally (9), toxic. Of these the cerebro-spinal and neurotic insomnias were chiefly presented. Here there is little hope from the protracted administration of hypnotics, sedatives, and narcotics; but, on the contrary, we might look for results the opposite of satisfactory. Under some conditions it may be necessary to adopt the routine administration of hypnotics, not only with the hope of cure, but also as a means of keeping a restless patient quiet. Yet without drugs and by simple physical means it is easy in many cases to restore normal arterial tension and cause sleep. In the insomnia of acute mania the warm bath is often of the greatest value. Usually water is used at a temperature not exceeding 104° F., and this is continued for twenty minutes or more while cold applications are made to the head. This temperature is safer than that of 110° F., as advised by some authors, and there is less danger of producing collapse, a danger never absent in a case of mania. Of course, the warm bath is contra-indicated when heart-failure is threatened or when organic heart trouble is present. Sometimes the time-honored cup of hot milk at bedtime induces the sleep habit, and when a stimulant is indicated a hot toddy is oftentimes worth a dozen doses of chloral or its equivalent. Insomnia occurring in neurasthenia is possibly one of the most difficult and unsatisfactory forms to deal with, but a study of the arterial pressure at the radial pulse will invariably show that in this condition the pressure is lowered. If the feeble heart is strengthened with digitalis, sleep is possible. In many cases one can substitute the

dynamic agents, massage, frictions, douches, and transfusions, and at the same time caffeine and digitalis can be employed. For those who are driven to do their thinking in bed, a glass of hot milk on retiring or a half-pint of bitter ale answers every purpose. Change of air is extremely valuable, and for most persons of a nervous type an outing under canvas in the northern woods of Canada is a sleep producer of the most remarkable kind. Certainly simple methods should be tried before drug treatment is decided upon.

Dr. Reynold Webb Wilcox prefaced his remarks by the statement that the treatment of insomnia is the treatment of a symptom. The disease of which insomnia is a symptom should be sought out and treated; in this way many and diversely-acting drugs were indirect hypnotics. He denied that organic brain disease was caused by insomnia, but rather that this symptom demanded an effort to seek out obscure brain affections. When all had been accomplished by hygienic and physical measures which was possible, there yet remained an important place which drugs and drugs alone could occupy. Routine prescribing is utterly indefensible; equally so is the reckless administration of drugs. Insensibility is not sleep. The smallest amount, and that of the most harmless drug should be selected. We desire sleep-persuading not sleep-compelling drugs. In ascertaining the mode of action he reviewed the physiology of sleep, noting the various chemical and physical theories which have been advanced. The theory of Howell explains chiefly the good effect of hot baths, but aids little the theory of drug action.

The theory of the neuron of Rabl-Rückhard, taken in connection with the observations of Hodge and the work of Ramon y Cajal, gives the best working hypothesis for pharmacological investigation. Quoting Dercum, that sleep is explained as follows: "The cortical cells in the motor area have processes extending toward the surface—dendrites—and a protoplasmic process extending downward through the white matter of the brain, internal capsule, the crus, the pons, the medulla, and into the spinal cord, where it terminates in a brush-like extremity—the end tuft. Here it has a certain relation to the motor cells in the anterior horn of the cord—probably one of contact, though this is not definitely known. If the nerve-cells retract this contact is broken; if the abnormal contraction of the nerve-process is relieved for the time being, contact once more takes place." Evidently, if the neurons are functionally active, their dendritic processes must be in contact; without this consciousness is impossible. When the nerve-cells are exhausted by fatigue, there is every reason to believe that their volume shrinks, and it is, therefore, more and more difficult for them to remain in contact. When relaxation comes, the processes retract and unconsciousness —that is, sleep—supervenes. The action of drugs is probably to induce this severance of contact, and the studies made upon alcoholic radicles and chlorine compounds are cited, the depressing effects of these and their neutralization by amide radicles being set forth. Of individual drugs, he believed that opium and its alkaloids should be excluded from our list of hypnotics, because of their various dangers, and those who persisted in their use showed a paucity of therapeutic resource not warranted at the present time. The hyoscyamus derivatives appeared to be useful in the insomnia of the insane, but in daily practice were not to be chosen for obvious reasons. Of the oxygen derivatives of the hydrocarbons, amylene hydrate and methylal were

of limited use and untrustworthy. Paraldehyde was useful, but habit is formed in spite of the abominable odor which it gives to the breath; cases of delirium tremens from its use have been reported. Chloral was popular, but habit was readily formed, and its use was attended by dangerous and even fatal results which were frequently not to be foreseen. Chloralamide was almost absolutely safe and by far the best of the chloral derivatives. Chloralose had given rise to serious depression. Hypnal and hypnone were entirely untrustworthy. Of the sulphur derivatives of the hydrocarbons sulphonal was often delayed in its action, and fatal cases had occurred. He cited the cases of hæmatoporphyrinuria, presenting the symptoms of abdominal pain and vomiting, with fatal collapse. The exanthemata were common. In view of the indiscriminate use of this drug by the laity, he believed that its use by the profession should be discouraged. Trional is a far better remedy than sulphonal, although from this exanthemata are frequently seen. It is more rapid in its action, and the danger of hæmatoporphyrinuria more remote. By giving alkaline mineral waters during its administration, and omitting it for two nights each week, it did not so readily lower nutrition. Tetronal presents no advantages over trional. Of the urethanes, ethyl urethane, commonly known as urethane, is useful as a mild hypnotic and when a change is necessary. Chloral urethane, known as ural, as well as its alcoholic solution, somnal, presents all the disadvantages and none of the advantages of the substances of which it is composed. It is probably a mixture and not a chemical compound. Of the remedies from the vegetable kingdom he cited but one as a valuable hypnotic, and that could be used hypodermatically. That is pellotine, from the Anhalonium Williamsii, a Mexican cactus. In dose of one-half grain it gave quiet sleep of satisfactory duration. Discarding unsafe and unreliable and unsatisfactory drugs, he compares four, as follows: (1) Potency: paraldehyde, chloralamide, pellotine, trional. (2) Rapidity: pellotine, paraldehyde, chloralamide, trional. (3) Duration: trional (longest), chloralamide, pellotine, paraldehyde. (4) Habituation: pellotine (slight), trional, chloralamide, paraldehyde (considerable). (5) Safety: chloralamide, pellotine, paraldehyde, trional. By using these drugs judiciously, in no department of therapeutics can we add so much to the comfort and well-being of our patients. On the other hand, in scarcely another can we so readily lay the foundations for temporary inconvenience and lasting detriment.

Mr. Alexander McPhedran presented the contraindications and ill effects of hypnotics. From the bromides we have, in addition to the general cachexia, with loss of appetite, disturbed digestion, anæmia, loss of memory, mental apathy, and commencing paralysis and trembling of the extremities that may be developed from their immoderate use. There may also occur marked mental aberration and alarming homicidal tendencies. Sulphonal, even in moderate doses, may give rise to fatal results. Trional may produce various disturbances of consciousness, speech, and hearing, and of vision, loss of memory, and ataxia of movements in general. Paraldehyde has been followed by serious effects, great dyspnœa and collapse, marked delirium, with paresis of the functions in general, and the formation of a habit has been observed.—*British Medical Journal*, 1897, No. 1918, p. 853.

A Protective Collodion.—Dr. Klein recommends for small wounds, and particularly for the physician's hands, a collodion to which 10 per cent. of balsam of Peru is added. This gives complete elasticity, a remarkable adhesive power, and a film which frequent washing cannot detach.—*Therapeutische Monatshefte*, 1897, Heft 4, S. 238.

The Results of Injection of Anti-streptococcal Serum in Twenty Cases of Malignant New Growths.—Dr. J. Ziemacki has obtained his material from cultures of the streptococcus pyogenes with which goats were immunized; later, horses were employed. Of the twenty patients observed, six suffered from sarcoma; the remainder from carcinoma. The results were absolutely negative; in not a single instance was the growth of the neoplasm retarded. Of the twenty, twelve are dead, three dying; and of the others the result is unknown, but they are doubtless dead. The ulcerating growth did not clean up better under the influence of the serum so that it presented a more favorable appearance. In two instances the carcinomatous masses became softer as carcinomatous and sarcomatous masses do when they suppurate, which is the fate of all such old masses. On the contrary, there is no doubt but in the single instance of lympho-sarcoma repeated injections favored rapid dissemination of the disease about the original mass. Aside from the question of failure of the method, it can be certainly stated that in weakened and marantic individuals these injections are absolutely contra-indicated.—*St. Petersburger Medicinische Wochenschrift*, 1897, No. 35, S. 333.

The Sero-therapy of Tetanus.—Mr. Ed. Nocard divides his subject into: (1) Curative measures. When tetanus has declared itself the antitoxic serum is without effect; it cannot prevent the fatal termination, whatever may be its antitoxic power or the dose injected. It cures only those who would have been cured without it. But in these cases it should be used, even if it does not decrease the mortality, for under its use the recovery takes place more speedily, the crises are less frequent and intense, and the convalescence is shorter. (2) Preventive measures: antitoxic serum injected in small dose at the time of the suspicious injury, whether accidental or surgical, or even a short time after it, prevents the onset of tetanus. The dose should be larger when it is administered late, and then it is better to give an intravenous than a subcutaneous injection. In this case it does not always prevent the onset of the disease, but it is likely to be mild and be promptly cured, even if the dose of toxin which has been received is a fatal one in test-animals.—*La Médecine Moderne*, 1897, No. 71, p. 566.

Dr. Max Engelman has collected eighteen instances of this method of treatment; in these death resulted seven times. He concludes: (1) Both Tizzoni's and Behring's tetanus-antitoxins favorably influence the course of the disease. (2) They are harmless even in large doses. (3) The severer the symptoms the earlier they should be used. (4) The difference in the action of these antitoxins is not accurately determined.—*Münchener Medicinische Wochenschrift*, 1897, No. 34, S. 938.

The Use of Antitoxic Serum in the Treatment of Diphtheria.—Mr. Lennox Browne presents his second report discussing the mortality from

that disease in the hospitals of the Metropolitan Asylums' Board between January 1 and December 31, 1896. The number of cases treated with antitoxin was 2764, and 1411 without. In this report it is claimed that the mortality from diphtheria in 1894, prior to antitoxin, quoted as 29.6 per cent., has been lowered in 1896 to 20.8 per cent. As a matter of fact, this claim of the lowering of the "combined general mortality to a point below that of any former year" is obtained by the inclusion of results in cases not treated with serum in the mortality tables of those so treated. As a matter of sober truth, the death-rate of those treated with antitoxin in comparison with those treated without it should read as follows: 1894, 29.6 per cent, prior to antitoxin; 1895, 28.1 per cent. with antitoxin, 13.4 per cent. without antitoxin; 1896, 25.9 per cent. with antitoxin, 10.8 per cent. without antitoxin.

Obviously it will be answered that the lower mortality of the cases treated without antitoxin illustrates their extremely mild character. But according to the report the cases in which serum was not used have been, on the one hand, those which at the time of their admission were moribund, or so far advanced in the disease as to be beyond the reach of any treatment; or, on the other hand, doubtful and for the most part mild cases. An examination of these classes reveals that only 4 of 154 fatal cases were certified as mild on admission, 1 other did not seem very ill, whereas 63 are noted as having been in a moribund or hopeless condition on admission. So that if we make the same allowance for the cases not treated with antitoxin as for those treated with it, by eliminating these moribund cases, we should find that the death-rate in 1348 patients not treated with antitoxin was only 6.4 per cent. against 25.9 in 2764 treated with it. There remain of these 154 fatalities in the 1411 cases not treated with antitoxin 85, against which there is no note made as to the mildness or gravity on admission. Looking, however, to the stated cause of death in them, we have borne in upon us most conclusively the correctness of the view of those who hold that no case of diphtheria can ever be asserted to be mild until it is completed; and if belief in the innocuousness of serum treatment and its great benefit is as complete as is often announced, we cannot understand why, on any ground of common sense, apparently mild cases should be excluded. Lastly, there remain the doubtful cases; but one, so noted, died, and that refers to a patient aged seventy, with "carcinoma of the fauces." No change has taken place in the local treatment previously employed, and it might be added with truth that internal remedies have been by no means neglected. Thus, from the point of view of "general lowness of mortality," it cannot be claimed, even by the most ardent advocate, that all the credit for any reduced death-rate is due to serum-therapy. Indeed, with all the allowances claimed, the mortality of nearly 5000 cases treated with antitoxin in 1895 and 1896 is only 1½ per cent. less than that for 1894, on about 3000 cases before antitoxin was introduced; and by no manipulation of figures can this fact be gainsaid. As to the effect of antitoxin upon children under five years of age, suffering from diphtheria, an analysis of the latter shows that 1346 were treated with antitoxin in 1896, with a mortality percentage of 32.2. Of 440 cases treated without antitoxin the mortality was 24.3 per cent. No less than 49 of these were moribund on admission; the corrected record should read 391 cases, death-rate 15.5 per cent. This is less than one-half of that experienced in

cases treated with antitoxin. And "the high fatality of diphtheria in the early years of life is notorious!"—*Medical Press and Circular*, 1897, No. 3030, p. 555.

Immunity and Sero-therapy in Yellow Fever.—Dr. G. Sanarelli reports that the serum of blood from cadavers distinctly produces in cultures *in vitro* of the icteroid bacillus the phenomena of Grüber-Durham (arrest of motion and agglutination), but the intensity of this reaction is very variable. When inoculated in animals it does not show any preventive power toward the specific bacillus. Serum (transudates) obtained pure from the pericardial cavity possesses an agglutinating power much less than that presented by serum obtained by coagulation of the blood, and often fails entirely. Serum obtained from the blood of convalescents produces the Grüber-Durham reaction with great slowness, but manifests a weak preventive action in animals against the icteroid bacillus. As for the other serums, the antidiphtheritic produces agglutination of the icteroid bacillus with great rapidity; the antityphus in a partial manner; the normal serum of man and various animals does not produce it at all. Immunity for guinea-pigs against experimental yellow fever is only obtained after six or seven months of assiduous and delicate treatment. With dogs this immunity can be obtained after about two months. With horses the process is by no means of easy *technique* or of such rapid results as in the antidiphtheritic vaccination. Frequently accidents arise which imperil the life of the animal, and it is only after five or six months that it is possible to inject small doses of living cultures. Making use of the serum of immunized guinea-pigs, twenty-four hours before or after inoculation with virulent culture, it was found that this would prevent death, for of twenty animals treated, but three died between the tenth and sixteenth day, and the remaining ones recovered after a progressive emaciation which lasted about two weeks. Observations with dogs and horses gave similar results. For rabbits, which, on the contrary, are singularly susceptible to the icteroid bacillus, we have not a serum sufficiently active to save them. The preventive and curative action of the serum of guinea-pigs, dogs, and horses vaccinated against the icteroid bacillus should be considered as positively proven for animals. Other serums, as normal human, antidiphtheritic, antityphic, or antivenine (of Calmette), have not given any results in the way of a specific action against the microbe of yellow fever.—*Il Policlinico*, 1897, No. 20, p. 527.

The Treatment of Experimental Tuberculosis with Antitoxic Serum.—Drs. E. A. de Schweinitz and Marion Dorset report that the injection of the living culture produced substances antitoxic, to the disease, which will cure tuberculous animals; that the quantity of this substance can be increased gradually; that the treatment is, and will be for some time, still in the experimental stage. One point, however, must be remembered: that while it may be difficult to cure the disease in a guinea-pig, where its course is very rapid—a virulent bacillus requiring only from four to five weeks to kill—it might be much easier to check the disease when more prolonged in action, as in the majority of cases in man. Again, in addition to some form of specific treatment for the disease, man usually has the advantage of being

placed under the best possible surroundings as to diet, climate, etc., and every effort is made to aid the improvement of the patients, while with experimental animals the conditions are different. As to experiments with tuberculin, it may be said that these produce a serum containing antitoxic material, but the amount of this is small.—*New York Medical Journal*, 1897, No. 973, p. 105.

The New Tuberculin (Koch).—MM. LETULLE and A. PÉRON, from a study of six patients, offer the following: Two improved considerably, even without treatment. One, however, presented a new bacillary focus after immunizing treatment. Of two patients severely affected, one of galloping consumption, underwent no change. The other, genito-urinary tuberculosis, was improved, but only so far as concerned vesical pain, for the lesion continued to caseate and be evacuated during and after treatment. Of the remaining ones, one emaciated, while the other sensibly improved, but the improvement was not remarkable, and it is doubtful if it persisted; besides, the *bien-être* did not correspond to a real improvement, but to the well-known effect of suggestion. From these observations and the experiments recorded earlier in the paper, this new substance does not appear to be the immunizing substance so much desired.—*La Presse Médicale*, 1897, No. 69, p. 101.

The Treatment of Diabetes.—DR. E. MAUREL, from a careful study of results of a milk-diet in this disease, offers the following conclusions: (*a*) From the practical stand-point: (1) The treatment of arthritic diabetes, both preventive and curative, is entirely a question of the amount of ailment. (2) The regulation of the amount is easier with a milk-diet, and this should have the preference. (3) This diet also possesses the advantage, at the same time, of combating the majority of the diseases which so often accompany diabetes, especially those of the digestive and urinary organs. (4) His observations show the efficacy of this diet in the most severe complications of the disease, diabetic gangrene and threatening coma. (*b*) From the theoretical standpoint: (1) His observations confirm the view that arthritic diabetes is largely due to superalimentation. (2) They also give serious support to the view that diabetes is only a means of defence employed by the organism to diminish, by the elimination of the sugar, the substances destined for combustion, consequently the amount of products of incomplete combustion.—*Bulletin Général de Thérapeutique*, 1897.

Salophen in the Treatment of Articular Rheumatism.—M. L. GALLIARD, although not believing that the ideal medication has been discovered, has studied fifteen cases of various kinds of rheumatism. The drug failed in chronic polyarticular rheumatism. Of so-called gonorrhœal rheumatism, there was one success and one partial failure. In the subacute variety there was no result. Of nine cases of acute disease the results in three were good, three fairly good, and three moderate. In none was there an excellent result such as is found, under some conditions, with sodium salicylate. He concludes that it is in the acute variety that the good effects of the drug are manifested. It can relieve pain, reduce swelling, abolish the fever, and prevent visceral manifestations. It should be administered at the outset in daily amount of

ninety grains taken in six doses in starch wafers. It is always well borne; there is no malaise, nausea, vertigo, or ringing in the ears. It increases diaphoresis. There have been no marvellous results. In equal dose it is a little less rapidly efficacious than sodium salicylate.—*La Presse Médicale*, 1897, No. 56, p. 13.

The Treatment of Chronic Articular Rheumatism.—Dr. Max Schüller notes that, contrary to what might have been expected, these joints contain little or no fluid, and never pus. In connection with the condition which he described as early as 1893 as polyarthritis chronica villosa, which should be clearly separated from acute articular rheumatism, he has found a special bacillus which occurs as broad, short rods. In twenty-nine instances he has made use of repeated injections into the joint. Generally, the following formula was employed: Pure finely-powdered iodoform, 20; pure acid-free glycerin, 250–400; pure guaiacol, 5. This is to be injected with a syringe which has been treated in a steam sterilizer, and all aseptic precautions must be taken. Of the joints treated—one shoulder, five elbow, two hand, five finger, two hip, thirteen knee, and one foot—in sixteen the chronic inflammatory process and the villous mass completely disappeared. In the knee five or six injections were necessary, using two and one-half to four drachms of the preparation. Pain regularly, but fever seldom, resulted from the treatment, and these disappeared within two days. More rapid cure followed opening of the joint, after fixation, with removal of the diseased synovial membrane and of the villous mass. The wound was then sutured and the same material injected. The sutures were removed after eight or ten days, and the fixation apparatus removed. After about the same time motion was permitted, and, later, electricity, massage, inunction, and baths were employed. The results were absolutely normal, movable joints. Eleven knee, one elbow, two hand and radio-ulnar joints have been operated upon. In anchylosed joints a small portion of bone was removed. This operation, however, was reserved for the more severely affected articulations. —*Verhandlung des XV. Congres für Innere Medicin zu Berlin*, 1897, S. 127.

Eucain B. in Stomatology.—MM. Dumont and A. Legrand make use of a 1 per cent. solution sterilized by boiling. They report seven observations, concluding that it is a good local anæsthetic, producing anæsthesia as rapidly as does cocaine, but which persists for a shorter period (about three times less), and that its feeble toxicity permits its safe employment in dental surgery even when practised upon children.—*Bulletin Général de Thérapeutique*, 1897, 18e liv. p. 545.

Eucain.—Dr. M. G. T. Garcia reports his observations upon the use of this drug in from 2 to 4 per cent. solutions in genito-urinary surgery, especially for introduction of sounds and urethroscopic examinations. In no case has he noted irregularity of pulse or respiration. It may be employed as a substitute for cocaine in all cases where hyperæmia is not contra-indicated. He concludes that it is less toxic than cocaine, while possessing an anæsthetic action at least equal to and often greater than the latter. Its solutions can be sterilized by boiling, and aqueous solutions are stable.—*Revista Mensual de Medicina*, 1897, No. 1, p. 18.

MEDICINE.

UNDER THE CHARGE OF

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The Relation of the Spinal to the Cranial Cavity.—NÖLKE (*Deutsche med. Wochenschrift*, 1897, No. 39), reports a number of cases from Quincke's clinic that throw an important light on the relation of the spinal and cranial cavities and the pressure in these as determined by lumbar puncture. In a number of cases in which this operation was performed, either a low pressure or a remarkable fall in the pressure was observed. As an example may be mentioned a case of suspected brain tumor, possibly of chronic serous meningitis. A high intracranial pressure seemed probable from the symptoms—headache, vomiting, optic atrophy. The spinal puncture showed at first a pressure of 200 mm. of water. The fluid escaped slowly, and after 5 c.cm. were removed the pressure fell to 10–40 mm. Respiration ceased suddenly and could not be restored. Autopsy revealed a marked chronic hydrocephalus, the ventricles containing over 80 c.cm. of fluid. At the base, pressing on the optic nerves, was a small tumor, and in place of the hypophysis was a soft tumor which had broken into the antrum of Highmore. The tumor had narrowed the foramen magnum and obstructed the foramen of Magendie indirectly, the total occlusion probably taking place during the operation. In other cases, notably in a case of simple hydrocephalus, it seemed as if obstruction was due to pressure of the brain-mass against the wall. In some cases the obstruction was spontaneously relieved. The sudden obstruction may explain the headaches sometimes noted after puncture, and also some cases of sudden death after that operation. Nölke also noticed striking differences in the amount of albumin in the spinal and cranial fluids, which further research may show to be normal.

A Case of Gastric Tetany.—BERLIZHEIMER (*Berliner klin. Wochenschrift*, 1897, No. 36) adds to the small number of cases of gastric tetany already reported. The patient was a man, aged thirty-five years, with dropsy of the gall-bladder and dilated stomach. From time to time tetaniform convulsions occurred. Trousseau's phenomenon was easily produced. There was trismus. The facial sign was not distinct. The stomach-contents gave a negative test for ptomaïnes. Injection of the contents in animals was negative. Autopsy showed abscess of the pancreas and compression of the ductus choledochus, with dilatation of the stomach due to stretching. An infectious origin of the tetany (there was peritonitis) is excluded. In a case previously reported from von Jaksch's clinic tetany followed paracentesis of the

abdomen. In the present case the gall-bladder had been aspirated, but not until after the tetany began.

The Spinal Changes in Pernicious Anæmia.—G. VON VOSS (*Deutsches Archiv für klin. Med.*, Bd. lviii. p. 489) has made a careful clinical and experimental study of this subject. From the clinical material examined, as well as a study of the literature, he draws the following conclusions: 1. The anatomical basis of the spinal degeneration in pernicious anæmia may be considered established. 2. Pernicious anæmia must be considered an etiological factor in the production of combined system disease of the spinal cord. 3. Vascular degenerations belong to the type of the disease in question, but are not the essential causes. 4. The frequently observed hemorrhages do not account for the origin of the spinal disease. 5. The question as to the cause of "pernicious anæmia," and the question as to the relation of the anæmia to the spinal disease are cardinal ones in any investigation of the subject.

After considering the possible explanations advanced, von Voss gives the results of some experiments made by him in order to see if induced anæmia could produce in animals spinal changes like those found in pernicious anæmia. As the result, he found that no typical changes could be produced in rabbits resembling those in man, nor could any alterations at all be produced in dogs and guinea-pigs, although the extent and duration of the anæmia were often very great. Von Voss, therefore, concludes that an as yet unknown poison is the cause of the peculiar spinal degeneration of pernicious anæmia, and that investigations of the metabolism in that disease are best calculated to clear up the subject.

The Aspiration of Stomach Contents in Artificial Respiration. — A. BROSCH (*Deutsches Archiv für klin. Med.*, Bd. lviii. p. 604) publishes some interesting results, of value not only in legal medicine, but also in practice. His attention was directed to the subject by the case of a convalescent from diphtheria, who suddenly fell over on rising from the table. The physician who was called in kept up artificial respiration for some time, but without success. The most important post-mortem finding was the presence of food in the trachea and bronchi, the stomach also being full. Brosch carried out an extensive series of experiments for the purpose of ascertaining whether such an aspiration could occur after death, from artificial respiration, and found that it was by no means difficult, especially if the stomach is full and the method of respiration one which includes pressure on the abdomen to force up the diaphragm. It is easy to understand how, in a convalescent, heart-failure might occur as the result of an over-distended stomach, and how, in case artificial respiration had been carried out and aspiration of stomach-contents followed, the real conditions might be difficult to explain. In order to avoid such accidents, the author recommends the insertion of a rather stiff-walled stomach-tube of wide calibre to lessen the risk of aspiration in case the contents of the stomach be expressed, and the use of a method like Howard's, or, still better, Marshall Hall's. The stomach-tube also serves a useful purpose in preventing the tongue from falling back and obstructing the larynx.

Balantidium Coli and its Action in the Intestine.—JANOWSKI (*Zeitschrift für klin. Med.*, 32, p. 415) reports the case of a man with severe chronic diarrhœa. There was no evidence of dysentery, malaria, or tuberculosis. The symptoms began three days after an excessive meal, including a great deal of pork and various kinds of sausage, followed by a large quantity of water. Opium and bismuth had no effect, unless to increase the diarrhœa. There were six to eight large stools daily, without pain, but with borborygmi, and followed by a dull pain in the anal region. In the examination of the feces, enormous numbers of balantidium coli were found. The patient was given quinine by the mouth and per enema for five days, by which time the parasites disappeared entirely, and, the other symptoms being much less severe, the patient left the hospital. That the parasites caused the diarrhœa in the beginning the author does not claim, though it can hardly be doubted that they had an important part in maintaining the chronic course.

Janowski gives an account of the salient points in the history of balantidium coli. Since the first report of Malmsten, forty years ago, only fifty-five cases have been published. Thirty-seven of these occurred in Scandinavia, Finland, and Russia. There was diarrhœa in all but one of the cases, but its relation to the parasites is made probable in only twenty-five, and in one case even large numbers were present without any apparent effect.

On the whole, however, the parasites when present in human intestines are to be looked on as unwelcome or even dangerous guests, and are likely to be associated with obstinate diarrhœa. In many cases the infection was noted in persons who had much to do with swine, and since the balantidium occurs almost constantly as a harmless parasite in these animals, the relation seems very close. Janowski also thinks contaminated drinking-water a not improbable source. In treatment, either quinine, as used by the author in the case now reported, or salicylic acid internally and in enemata containing one gramme to the litre, should be given for several days or until the stools are free from parasites.

Alpha-naphthol as a Reagent for Free Hydrochloric Acid.—F. WINKLER (*Centralblatt für inn. Med.*, 1897, No. 39) recommends a new test for free hydrochloric acid, which is really a reversal of Molisch's modification of a well-known furfurol reaction, and used by the latter as a test for glucose. Winkler uses either a 5 per cent. alcoholic or 10 per cent. chloroform solution of alpha-naphthol. To a small quantity of the suspected fluid a few granules of dextrose and a few drops of the naphthol solution are added. This is carefully heated. If hydrochloric acid is present a bluish-violet color appears, rapidly turning darker. Overheating masks the reaction. The grape-sugar may be added to the naphthol solution in the proportion of ½ to 1 per cent., or one can use milk-sugar or even milk. Hydrochloric acid in the proportion of 0.04 per thousand may be detected by this method. It does not respond to lactic or acetic, but does to sulphuric or phosphoric acid. In testing stomach-contents the reaction may occur without the addition of dextrose from dextrose found in the stomach from starch.

Acute Yellow Atrophy and Cirrhosis of the Liver.—VON KAHLDEN (*Münch. medicinische Wochenschrift*, October 5, 1897) believes that cases of

acute yellow atrophy of the liver which are not rapidly fatal develop into typical examples of cirrhosis of the liver. Before dealing with this point, he reviews briefly the causes of acute yellow atrophy.

Whereas pregnancy is considered an important predisposing etiological factor, only a small proportion of the recently published cases show this association.

Von Kahlden points out the relationship between acute yellow atrophy and epidemics of icterus, and mentions Meder's fatal case of acute yellow atrophy occurring in a soldier, who was one of fifty men who had suffered from jaundice in a barracks epidemic. Many other similar observations have been recorded.

Various poisons, of which the more important are phosphorus and arsenic, may cause the disease.

Of special interest are those cases which follow various infectious diseases. It has also been observed after osteomyelitis, erysipelas, diphtheria, phlegmon, septic gangrene, and streptococcus injections. The onset of acute yellow atrophy during the later stages of syphilis has been comparatively frequently observed. Meder states that eighteen or twenty of the reported cases have followed syphilis.

The association between infections with the bacterium coli communis and icterus or acute yellow atrophy has been more than once pointed out, particularly by French observers. Kamén found the bacterium coli communis in various internal organs in five fatal cases of Winckel's disease occurring in an epidemic in which six infants were attacked. Stroebe recently found the colon bacillus in the liver of a girl, aged twenty-one years, who died of acute yellow atrophy on the seventh day of the disease. It was proved in this case that the infection was through the portal vein.

Von Kahlden reports a similar case in a woman, aged twenty-eight years, who became suddenly ill on May 31, 1895, the patient dying on June 9th of acute yellow atrophy of the liver. Cover-slip preparations from the liver showed very numerous short bacilli with rounded ends, which were proved by the cultures to be the bacillus coli communis.

The subsequent changes in the liver in cases where acute yellow atrophy does not rapidly terminate fatally are then dealt with. Marchand found that the liver of a woman, who had six months previously had an attack of acute yellow atrophy, showed both macroscopically and microscopically a picture very closely resembling cirrhosis of the liver. Stroebe reports a similar case showing marked evidences of cirrhosis only four weeks after the onset of the acute yellow atrophy. Von Kahlden relates a case of his own occurring in a woman, thirty-four years of age, whose illness began with an osteomyelitis of the sternum leading to spontaneous fracture. Following the osteomyelitis a general staphylococcus infection developed. During the course of the illness, and three and a half months previous to death, the patient had marked jaundice, which was attributed to the occurrence of acute yellow atrophy of the liver. The liver presented at the autopsy, both macroscopically and microscopically, a picture very similar to that seen in cirrhosis of the liver. Von Kahlden believed that in this case there had first been an acute yellow atrophy of the liver followed by cirrhosis, which he believes is the usual course in those cases where the disease is not rapidly fatal.

SURGERY.

UNDER THE CHARGE OF

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The Surgical Treatment of Diseases of the Vermiform Appendix.—BATTLE (*British Medical Journal*, April 17, 1897) describes the following method of operation in cases of appendicitis and in exploratory operations on the abdomen, with the purpose of avoiding the danger of hernia through the scar left in the abdominal wall.

An oblique incision is made in the right iliac region with its centre corresponding to the point which, in the opinion of the surgeon, is probably that of the attachment of the appendix, and its length varies with the patient. The direction of the incision is that of the linear semilunaris, and is usually about midway between the anterior superior spine of the ilium and the umbilicus. After the division of the skin and subcutaneous tissue the incision is carried through the aponeurosis of the external oblique and the outer part of the sheath of the right rectus muscle; this part of the incision is about one inch from the external margin of the sheath. The rectus muscle is then drawn toward the middle line, having been separated from the inner surface of the sheath with the forefinger. When the edges of the wound are retracted, the deep epigastric artery will be seen lying on the posterior layer of the sheath running from below upward. The artery is easily avoided, and the posterior layer of the sheath (or the transversalis fascia), the subperitoneal tissue, and the peritoneum divided to the full extent of the wound. The use of retractors will bring the area of operation well within reach. The small intestines can now be pushed toward the middle of the abdomen, the region affected isolated, the appendix amputated by the coat-sleeve method, and the peritoneum closed over it with Lembert sutures.

The abdominal wound is then sutured in three layers of interrupted sutures from behind forward, the rectus muscle being replaced and intervening between the first and second layer, thus preventing the formation of a hernia.

The author admits that the operation is somewhat longer, but thinks the security attained fully compensates for that. The appendix can be readily reached through this incision as well as other parts of the abdomen.

Recurring Appendicitis.—In a study of this form of appendicitis and its treatment by removal of the appendix, SOUTHAM (*British Medical Journal*, April 17, 1897) reports a number of interesting cases and gives the following

as his indications for operation: Operation is indicated after two well-marked attacks of appendicitis, especially if the physical signs—more particularly a swelling in the situation of the appendix—persist in the quiescent period after the subsidence of the attacks.

In two of the three cases reported as operated upon after a second attack small collections of pus were found in the immediate neighborhood of the appendix, while in the third the appendix was distended with fluid and upon the point of rupture. In another patient, operated upon after a third attack, a hard, fecal concretion was found in the appendix, probably the cause of the preceding attacks. When an appendix is constricted or occluded, and especially when it is distended with fluid or contains a fecal concretion, there is always a risk of ulceration and peforation taking place, followed by the escape of its contents and suppuration around it. This, through adhesions surrounding it, generally results in a localized abscess, which may, however, sometimes form with acute symptoms.

The Treatment of Fractures.—After reviewing the various methods for the treatment of fractures, G. V. BERGMANN (*St. Petersburger Med. Woch.*, 1897, No. 14) summarizes his method of treatment in the following principles:

1. True adaptation is secured by extension, counter-extension, and careful manipulation.

2. Immediate attention is paid to the exudation of blood, especially about joints, by careful massage.

3. Fixation of the fragments. Splints of various forms may be employed, but those should be selected that are the cheapest and most readily placed in position with the certainty of producing good results.

4. For a proper fixation of the fragments it is necessary to fix the joints on either side.

5. In certain fractures it is necessary to employ extension apparatus, as in oblique fractures with marked overlapping of the fragments and shortening of the limb. The extension must be carefully applied to prevent decubitus and atrophy of the muscles.

6. The commencing atrophy must be counteracted by changes of dressings and by early massage.

7. Special care must be given to fractures involving joints. Since there is danger in these cases of loss of function, massage and passive motion must be commenced as soon as possible. The result in these cases depends very much upon the intelligence and good-will of the patient. In general, the prognosis is better in younger than in older persons.

8. In compound fractures the greatest care should be given to the surroundings. The hair should be shaved and aseptic conditions surround the entire area.

9. The early return of the limb to functional usefulness is secured by frequent baths, massage, and passive movements.

The Operative Treatment of Cancer of the Breast.—The operation which he adopts as the standard or minimum necessary to meet the conditions of cure is described in the Ingleby Lectures by MAY (*British Medical Journal*, May 22 and 29, 1897) as follows, and includes the removal of the

entire breast-gland, the integuments over the area of the tumor and for some distance around, all the para-mammary, fatty, and areolar tissue extending upward nearly to the clavicle, a clean dissection of the pectoralis major, or, what is better, the removal of the costo-sternal portion of the muscle, and, lastly, a clean dissection of the axilla, thus including all the tissues likely to contain the lymphatic channels. The suspected tissues are always to be removed entire in one piece; never cut into.

The incision should be well planned beforehand, of the oval type usually, or an ellipse, a widely open oval, from four to eight inches wide at its widest part, according to the size of the tumor and breast. A minimum distance of two inches from the margin of the tumor is advised. The dissection should include the sterno-clavicular portion of the pectoralis major, while the axillary space should be scrupulously clean. The supra-clavicular glands should be removed if they are infected, although their infection adds to the gravity of the prognosis. It is never necessary to divide the clavicle, but muscles may be divided and reunited by buried catgut sutures. There is little hope of a permanent cure if the axillary vein is so closely involved that its resection between ligatures is necessary, although this may be done without danger if need be.

The lateral wall of the axilla may be now cleared with careful avoidance of the muscular nerves. The posterior wall of the axilla is frequently the most difficult part on account of the hemorrhage from the subscapular vessels. These should be exposed and caught before they are divided. The nerves may be nearly always spared uninjured. The cutaneous nerves may be sacrificed without inconvenience.

The dressing of the wound is difficult, and great care should be taken to apply proper and uniform pressure if rapid healing is attained. The author uses sterile gauze and any absorbent wool.

The mortality from this operation is remarkably low. He does not think it should exceed 2 per cent. from causes proper to the operation. He has not had a death in seventy-six cases, but one of his patients died from intestinal obstruction three weeks after operation.

A small gap may be relied upon to fill up quickly without suppuration if the wound be kept dry and aseptic. He has had some success in primary skin-grafting, but it is uncertain. He has on one occasion used a piece of the redundant skin which is cut away near the axilla. It is to be stripped of all fat and tissue, and kept in warm boric lotion till wanted. It should be shaped to the gap which it should nearly fill, and should be pressed down firmly, so as to maintain close apposition to the raw surfaces. Operative grafting after eight or ten days is the most successful, a strip being taken from the inner side of the arm or thigh, but on many grounds it is objectionable.

If we find during an operation that the highest axillary gland is involved so that it is not possible to pass beyond the limits of the disease, what are we to do? The author has no doubt, under these circumstances, the posterior triangle of the neck should be opened and cleaned of its glands as an addition to the ordinary operation. There is a reasonable chance of getting beyond the limits of the disease. The incision may be prolonged upward over the clavicle, but it is not necessary to divide or resect the bone, as has been done by some operators.

The author shows by tables that there has been a marked and gradual improvement in the number of cases as the operation has become more thorough and radical. The percentage of cures in 1876 was 4.7 to 11.8, while in 1896 it was 42.5 per cent. of cures.

Of his own cases, he has full reports up to date of forty-four private cases. Those operated on over three years are twenty in number; of these seven are now alive and free from any sign of disease; eleven have died from it, and two are alive, but show signs. Out of thirteen patients in whom the disease has appeared it was solely internal in seven.

Of the more extensive operations the author says there is no conclusive evidence that any corresponding advantage accrues from some of the more recent developments of the operation, and he is of the opinion that the utmost benefit of which it is capable may be conferred in a large majority of cases by the operation he describes. The cases in which this will not suffice are probably unsuited for operation.

Of the clinical varieties the medullary cancer is most unfavorable, and there is no chance except in very early operation. Of all the unfavorable modifying conditions he thinks rapidity of growth the worst. The actual duration is by no means the only criterion of the disease or its stage. A large tumor of the tuberous form, of slow growth and unattached, has a much more favorable prognosis than an infiltrating medullary one in its earliest stages.

At the other extreme is the small, chronic, dry infiltration of shrivelled and aged women, though not confined to old women. Opinions differ as to the propriety of operating on atrophic cancer. In his opinion it is a question of the stage of the disease. In an early stage they are most favorable of all, and should certainly be removed. Later, where there is any notable skin infiltration or attachment to muscles, the most radical operation is not only ineffectual but harmful. In Paget's disease he would advise immediate operation in every case of chronic eczema or ulcer of the nipple, even though no tumor is perceptible, as the relationship between this and cancer is constant. In all his cases the ulceration preceded the tumor by several years. In two of them the tumor was limited to the nipple, and of the kind known as duct cancer, and preceded by a bloody discharge from the nipple—a symptom of very grave significance.

Secondary operations are only advisable when the growths are small, solitary, and freely movable.

The complete operation should be performed in every case where operation is undertaken.

The limits of operation for cure and the non-operable cases he classifies as follows: Non-operable: 1. Large medullary cancer. 2. Scattered tubercles in the skin and œdema. 3. Internal metastases of all kinds. 4. Œdema and solid enlargements of the upper limb. This is a manifestation of the disease which he would absolutely let alone.

Among the debatable cases he includes:

1. Enlargement of the supra-clavicular glands. He has hitherto regarded this as an absolute contraindication, but is inclined now to extend the field of operation to some of these cases, clearing the supra-clavicular fossa as an addition to the ordinary operation. He would limit it, however, to small and movable tumors or when the highest axillary gland is infected.

2. Cancer in both breasts. It is rarely desirable to operate, especially if some time has elapsed between the appearance of the two tumors.

Diagnosis: Early diagnosis is of the utmost importance, and is only to be attained by a careful, full examination of the breast, with bare chest and careful comparison. Students are often taught only to recognize late stages. Cases of chronic hyperplasia and tense cysts are the most difficult. The latter is distinguished by its mobility, globular outline, and verified by the exploring needle, which should never be overlooked. Chronic mastitis is more difficult; the thickening is sensitive to the touch, firm, and elastic, but the outlines are more diffused than in cancer. On pressing the mass against the chest-wall the induration and sense of tumor disappear. Then, again, the area of breast occupied is more diffused and larger, or both breasts may be similarly affected. The same sort of dimpling may occur as in cancer, but this is quickly followed by fluctuation and suppuration.

A preliminary incision may be necessary to demonstrate the diagnosis before proceeding to a wide operation, but the wound must be rendered antiseptic, packed with gauze, and a new knife employed for the operation, giving the patient the benefit of the doubt in fear of autoinfection.

The hope of improvement lies in greater improvement in operation, but more still in a greater power to diagnose in the very early stages of the disease.

The Treatment of Spinal Curvatures in Pott's Disease by Forcible Extension.—MÉNARD (*Gaz. Heb. de Méd. et de Chir.*, May 30, 1897), after a careful study of the pathological conditions resulting from this disease, shows that this method of operating is without scientific foundation, that it cannot be based on anatomical grounds or upon experimental knowledge obtained by work upon the cadaver.

Besides the injury of no one knows how grave a character that this violent treatment may produce, there is no reason to believe that there can be a permanent cure obtained, for pathological specimens obtained at various stages of the disease show that no new growth of bone occurs to take the place of the bone destroyed by the disease, and there is no growth which can fill up the gap left where the vertebræ have been destroyed and give a sufficient solidity to the spinal column.

The author, therefore, concludes that this operation has no foundation except in theory, is dangerous to the patient in its performance, and has neither given results that prove its value nor has to back it pathological facts which would lead one to suspect that it will give the desired results to produce cures.

The Treatment of General Septic Peritonitis.—Since adopting as a routine procedure the intraintestinal injection of sulphate of magnesia the results of operation have been so much more favorable than those of former years that MCCOSH (*Annals of Surgery*, June, 1897) cannot but believe that, in a measure at least, this improvement is due to the injection into the small intestine of a saline cathartic. There may have been other changes in the mode of operation and technique, but the author's former experience leads him to place the credit to this special modification of treatment.

During the past year he has operated on eight cases of general septic peritonitis. One of these died as the direct result of the peritonitis, one died from lung complications five weeks after operation, five recovered and remained well, and one is still in the hospital convalescing.

There were two other cases that came in moribund that were not operated upon. The cases operated upon were not selected, but were the general run. In six cases a gangrenous appendix was the cause, in one a perforating gastric ulcer, and in one a septic uterus. The histories are reported briefly. The details of the operation may be summarized as follows:

1. Cholorform is employed as the anæsthetic.

2. A free incision is generally made five or six inches in length. Its situation varies according to the organ which has excited the peritonitis. The purulent fluid is allowed to flow out, its escape being often aided by turning the patient on the side.

3. As a rule, the intestines are allowed to escape from the abdominal cavity into hot towels held in the hands of assistants (the patient being generally turned on the side). In certain cases, where the distention is enormous and where the heart's action is very weak, any considerable escape of intestinal coil is prevented. Where possible, however, even at great risk, the intestines are removed, and, if well protected by hot towels, he has not found the evisceration increases to any great extent the shock of the operation. If the distention is such that their return is impossible, he does not hesitate to open the ileum and allow gas and feces to escape. The openings are closed by Lembert sutures. He has never seen any reason for establishing a temporary artificial anus by suturing the gut to the abdominal wall.

4. The cause of the peritonitis is removed. If it be an appendix or tumor, it is extirpated. If it be a perforation, it is sutured.

5. The intestines and the cavity of the peritoneum are thoroughly irrigated with hot normal salt solution at a temperature of 110° or 112° F. or over. A soft-rubber tube is passed about among the intestines, or they are well douched if they are outside of the abdomen. Irrigation is preferred to the swabbing by gauze pads or sponges, as the author fears injury to the peritoneum, which will produce a chance for absorption of septic material. A considerable amount of the salt solution is allowed to remain in the abdominal cavity for the purpose both of stimulating the heart and of favoring intestinal drainage.

6. Sulphate of magnesia is injected, through a hollow needle attached to a large aspirating syringe, into the small intestine at a point as high up as possible in the jejunum or ileum. A saturated solution containing between one and two ounces of the salt is used. The needle puncture is closed by a Lembert suture.

7. The peritoneal cavity is drained generally by four or more strips of sterile gauze thrust in different directions among the intestines, or other forms of drainage are used.

8. The abdominal wound is but partly closed by sutures. The edges are not closely approximated, but are generally partially drawn together by two or three silkworm-gut sutures, between which and the intestines is placed a compress of gauze. A wound that gapes somewhat affords freer exit for the escape of peritoneal secretions.

9. After the return of the patient to bed, if the condition of the stomach will permit, a ten-grain dose of calomel is given. If chloroform has been used, this will generally be retained. Rectal stimulation is used for the first twenty-four hours.

OTOLOGY.

UNDER THE CHARGE OF

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Elephantiasis of the Auricle.—HAUG reports the occurrence of elephantiasis of the right auricle in a girl aged twenty years. Ten years previous to the time Haug first saw the case the girl had had whooping-cough, during which hemorrhages from the left ear and extravasation of blood beneath the integument of the auricle took place. The long diameter of the enlarged auricle, measured from the spina helicis to the lobule, amounted to 12½ cm., and the transverse diameter, from the outer edge of the helix to the antitragus, to 7 cm. The breadth of the lobule amounted to 4½ cm.

Microscopic examination of a small piece revealed that the enlargement of the tissues consisted in a lymphangio-fibroma with hyperplasia of the cartilage and the perichondrium.—*Archiv f. Ohrenheilk.*, vol. xliii., Part I.

Myxo-cysto-fibroma of the Cartilaginous Auditory Canal.—HAUG also reports the occurrence of the above-named growth in the auditory canal of a man, aged thirty-eight years (*Archiv f. Ohrenheilk.*, vol. xliii., Part I.). The growth had been increasing in size for four years, had not been preceded by discharge, and had finally attained the size of a cherry. Within six months a slight, fetid discharge had set in, but the hearing had not been much affected.

The entire growth was removed with a cold wire snare. This was not followed by much hemorrhage. The tumor measured 2½ cm. in length. The membrana tympani was found to be intact and the hearing good.

Removal of Foreign Bodies from the Ear.—HUMMEL makes the following deductions respecting the relation sustained by the external auditory canal to foreign bodies in it, and gives some rules for the removal of such obstructions from the ear:

1. The relation of the normal ear-canal to inanimate foreign bodies is entirely without reaction—*i. e.*, the foreign body in the ear does not, *per se*, endanger the integrity of the ear.

2. Every hasty endeavor at removal, therefore, is not only unnecessary, but can become very injurious.

3. In all cases not previously interfered with (with very few exceptions), the foreign substance can be removed from the ear by means of syringing.

4. The general practitioner should never employ anything but the syringe, in his endeavors at removal of foreign bodies from the external auditory canal.

5. An instrumental removal of a foreign body from the ear sould be effected only by one fully able to examine the ear with an otoscope and acquainted with every operative manipulation in this region.—*Münchener med. Wochenschrift*, No. 17, 1897.

Acute Otitis Media in Infants.—Acute otitis media in infants is often confounded with cerebral disease, and hence escapes proper attention and treatment. In alluding to this form of disease, SIR WILLIAM DALBY (*British Medical Journal*, July 24, 1897) points out that in the case of infants the constitutional symptoms and demeanor of the little patient as indicating pain of an acute and agonizing character, or pain prolonged over many days, are the sole evidences within our hands of ear disease. The heightened temperature alone is not sufficient guide as to the necessity of paracentesis, and sometimes inspection of the drum-membrane will not show this necessity. "In a large proportion of cases leeches and hot fomentations will cut short inflammations of the tympanic cavity, but it would be safe to adopt the rule that when they do not (for if they relieve, they do so at once), a vertical incision should be made in the posterior section of the membrane." The incision does no harm, Dalby says, even if no pus is found pent up in the drum-cavity. Again, "in the infantile forms of this inflammation (not connected with the exanthemata), the process is often slow, subacute, the case dragging on day after day without the membrane giving way."

[These delays are dangerous, as a week's delay in rupture of the drum may lead to damming back of the pus, through the posterior wall of the drum-cavity, into the cerebellum, with fatal termination, as in a child of six years observed by your reporter.]

J. H. MARSH (*British Medical Journal*, July 24, 1897), in writing of this same important subject, thus tabulates the symptoms which should suggest the ear as the cause of the illnesses often attributed to other sources: 1. The child constantly endeavors to rub the affected ear. 2. It utters a sharp cry of pain on pressure being made below the meatus. 3. It refuses to rest its head on the affected side.

The same author states that "the clinical signs which would suggest that the lesion had a tuberculous origin are: 1. A slow non-sthenic onset. 2. Early glandular enlargement. 3. Early facial paralysis. 4. Resistance to the ordinary measures of treatment. 5. The presence of other tubercular disease. These cases require the establishment of a free opening into the middle ear through the mastoid."

[This last-named procedure *should not* precede removal of the carious and necrotic ossicula. The latter operation will generally check the suppuration and do away with all necessity for opening the mastoid. If the mastoid is opened in such cases, and the carious ossicula are left in place, as I have seen done, suppuration with all its attendant risks of deeper lesions will continue, to stop only after a removal of the carious ossicula.]

E. PONFICK (*Berlin. klin. Wochenschrift.* September 20, 1897) points out that in children under four years of age great confusion in diagnosis often arises

in the presence of a gastro-enteritis, symptoms of which may be mingled with those of an acute otitis media, or which may depend more upon the otitis media than upon the gastro-enteritis, though the otitis media may not be recognized promptly. Often, in fact, the latter disease is discovered accidentally either by observing a discharge from the ear and improvement in the symptoms of the gastro-enteritis, or by touching the auricle or the region near it, when the latter is found to be tender and painful to the touch. Treatment of the ear will be followed by recovery in all respects, in most instances, if the aural treatment has not been deferred too long.

OPHTHALMOLOGY.

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Diphtheritic Conjunctivitis.—MYLES STANDISH (Boston) finds that there are many cases of diphtheritic disease of the eye which do not present the classical clinical picture of so-called diphtheritic conjunctivitis—that many more of the destructive processes are diphtheritic than had been supposed.

He urges the importance of early bacteriological diagnosis, for the reason that in his experience the cases treated early with antitoxin run a milder course, and the cornea is generally saved, with resulting preservation of vision. He reports three cases, and, from these and other cases he has seen, draws the following conclusions:

1. In all cases of purulent conjunctivitis the diagnosis should depend upon the bacteriological investigations, and not upon the clinical appearance.
2. That diphtheritic conjunctivitis may be present in localized areas without the conjunctiva being affected as a whole.
3. That ulcers of the cornea with exceedingly rapid necrosis of the corneal tissue may be due to infection with the Klebs-Loeffler bacillus.
4. That antitoxin favorably affects both the conjunctival disease and the corneal necrosis.—*Ophthalmic Review*, vol. xvi. p. 133.

Double Optic Neuritis in Enteric Fever.—C. BRAINE-HARTNELL (London) reports a case of enteric fever running quite a regular course in a boy, aged eleven years, who upon the sixteenth day showed inequality of pupils, with marked double optic neuritis. The diagnosis had been undecided as to enteric fever or meningitis, there being an absence of eruption, but

little diarrhœa, and irregular temperature. The discovery of the optic neuritis inclined the diagnosis to meningitis. But two days later the boy died, and the post-mortem examination showed distinct inflammation of Peyer's patches and the solitary follicles, but nothing in the brain to give rise to optic neuritis.—*British Medical Journal*, 1897, p. 1344.

The Treatment of Vernal Conjunctivitis.—DARIER (Paris) says the treatment of spring catarrh may be summed up as follows:

Soothing remedies, bathing with water, or water in which carbolic acid or creolin has been dissolved. By these means is obtained the most rapid and marked relief. These may be employed three or four times a day.

Generally, applications of nitrate of silver or sulphate of copper are not indicated, and do good only when the stringy, muco-purulent secretion is pretty abundant. In the pericorneal form of spring catarrh the best treatment is massage of the cornea with mercurial ointment, made up with lanolin. It is true that after three weeks' or a month's daily massage of the cornea with the ointment the characteristic pericorneal circular swelling does not entirely disappear; but no other treatment has given results equal to or as favorable as this.

For the tarsal form of the disease, in those comparatively recent cases in which the papillary hypertrophy is not excessive, scarification, with the lines of incision close together and crossed, is of very considerable service. These scarifications are repeated every four days for several weeks. After scarification the more exuberant papillæ may be removed with the curette. This treatment brings about a relative cure in two months, but it may be necessary to complete the cure by repeating the treatment for two or three seasons.—*Annals of Ophthalmology*, July, 1897.

Syphilitic Neuro-retinitis.—LYMAN WARE (Chicago) has not seen a single case of syphilitic neuro-retinitis following thorough and prolonged antisyphilitic treatment.

It never terminates in spontaneous recovery. Without treatment it is sure to end fatally. The most skilful treatment, even begun at an early stage of the disease, may prevent a fatal termination in many cases, yet often life is rendered miserable and sad by partial or total blindness. Large doses of potassium iodide are of value in arresting the disease in some severe and dangerous cases, but they do not compare with mercury in eradicating the syphilitic poison. The manner in which the mercury should be used is of secondary importance. For years he relied mainly on inunctions, but recently has resorted to hypodermic injections of the preparation proposed by Althaus, which consists of metallic mercury, 1 part; lanolin, 4 parts; carbolic oil (2 per cent.), 5 parts.

The usual dose, five minims, may be gradually increased to ten, giving an injection once a week, in the region of the glutei muscles.—*Archives of Ophthalmology*, 1897, p. 345.

Effects of Strain of the Accommodation.—W. SCHOEN (Leipsic) thinks chorio-retinitis of the ora serrata comes on with other symptoms in eyes with

strained accommodation, and appears in an acute or a chronic form, the former accompanied often with opacities of the vitreous and scleritis.

The causes are hyperopia and astigmatism according to the rule. The results are astigmatism against the rule, equatorial cataract, accommodative excavation, latent convergent strabismus, and chorio-retinitis of the ora serrata.

When the ora serrata is displaced forward the zonular fibres slacken, the lens pushes the iris forward, and the width of the chamber-angle is lessened. These changes, according to their extent, fall into four categories: 1. The normal position of the iris and lens. 2. Ordinary accommodation, the outer half of the iris concave, the inner half convex, the anterior chamber shallower in the centre. 3. Pushing forward of the entire iris, more or less noticeable prolapse of the lens, convexity of the entire surface of the iris, shallowing of the entire anterior chamber. 4. Apposition of the iris to the cornea, obliteration of the anterior chamber, absolute glaucoma.

The pressing forward of the lens leads to an increase in refraction; and the tilted position which it may assume leads to acquired astigmatism, usually against the rule. The author's cases of glaucoma have almost exclusively been in eyes with uncorrected hyperopia or astigmatism, and he believes that the correction of the refractive error would, in many cases, have prevented the development of glaucoma.—*Archives of Ophthalmology*, 1897, p. 428.

DERMATOLOGY.

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Massage in Skin Diseases.—WILLIAM TIBBLES (*British Medical Journal*, January 9, 1897) speaks in favor of this method of treating acne, psoriasis, and various localized indurations. Massage as actually performed is, however, an unpleasant duty, and hence is not carried out so regularly as it ought to be. In place of the hand an India-rubber roller (such as the ordinary roller employed in photographic work) is recommended. It is easy of application and can be applied largely by the patient.

Impetigo Contagiosa Vegetans.—HERXHEIMER (*Archiv für Dermatologie und Syphilis*, Band xxxviii., Heft 2), in reporting three cases of impetigo contagiosa attended by the formation of vegetations at the site of the pustular lesions, concludes that these proliferations possess no specific significance, since they are found in very different forms of pustular and vesicular dis-

eases. He found, in studying these vegetations, that in a zone of the rete lying above the columnar cells, the epithelium is so altered in its formed elements that it no longer takes up stains. This peculiarity, the author thinks, may be useful in microscopic diagnosis, its presence probably indicating the proliferation of the skin after certain eruptive diseases.

Acute Miliary Tuberculosis of the Skin with Acute Miliary Tuberculosis of the Entire System.—The following case, noted by OTTO LEICHTENSTERN (*Münch. med. Wochenschrift.*, January 5, 1897), illustrates the rare observation that miliary tuberculosis of the general system may give rise to a disease of the skin of the same nature. Subject, aged four years, had measles four weeks before entering the hospital. There were no hereditary tendencies. On admission there were high fever and bronchial symptoms. Pulse 120 to 144. The skin was then normal. Loss of strength and emaciation set in, and at the end of six weeks' illness the child died of tubercular meningitis. The autopsy showed that the lungs, pleura, liver, kidneys, mesentery, and retro-peritoneal glands were affected. The spleen was enlarged; heart normal. The second week after patient's admission to hospital a disease of the skin appeared on the face, consisting of a limited number of small, bright-red, circumscribed, acuminated, hempseed-sized papules. As the disease advanced new ones formed on the back and the upper extremities, and later on the lower extremities, but sparingly. Most of them in from eight to fourteen days disappeared by drying up and desquamating furfuraceously; on the summits of others minute vesicles formed which dried quickly and desquamated; still other papules showed pustulation on their summits, but in no instance to such an extent as in pustular acne or impetigo. Pustulation was confined to the summits of the lesions. These, like the other lesions, dried up quickly and desquamated. In many respects the eruption resembled a sparse, disseminated, small, miliary papular and pustular syphiloderm. New ones appeared, while older ones disappeared. There was never any tendency to group. On microscopic examination the epidermoidal part of the papules showed a lamellated appearance, but the most important primary changes were in the papillary layer of the corium, where they formed 1 to 2 mm. broad lenticular tubercles, containing numerous tubercle bacilli. The epidermoidal structure seemed to be secondary. By degrees, under observation, following the cutaneous eruption of miliary tuberculosis there occurred an acute, multiple swelling of the lymph-glands of the neck, axillæ, and groins. In the fourth week of the disease on the mucous membrane of the mouth and on the tongue there appeared a miliary eruption, which rapidly broke down and changed into superficial ulcers covered with a speckled deposit.

The Anatomy of Lichen Ruber (Planus, Acuminatus, and Verrucosus).—JOSEPH concludes (*Archiv für Dermatologie und Syphilis*, Bd. xxxvii., Heft 1), from a study of the anatomy of the various forms of lichen, that we are justified, not only upon clinical but also on anatomical grounds, in asserting the unity of lichen ruber. To lichen ruber belong three symptom-groups—the planus, acuminatus, and verrucosus forms. The author believes that his investigations show a close anatomical connection between the different

clinical symptoms of the lichen process. Inflammation, beginning in the corium about the bloodvessels and extending to the more superficial layers, is the primary change; secondarily, hypertrophy of the epidermis and hyperkeratinization follow. A cure of lichen ruber verrucosus was obtained through the local application of chrysarobin-traumaticin (1 : 10) without the employment of arsenic internally.

The Permeability of the Skin.—MANASSEIN (*Archiv für Dermatologie und Syphilis*, Band xxxviii., Heft 3), who had the opportunity to examine sections of skin obtained from a syphilitic subject who died suddenly some days after using mercurial inunctions, arrives at the following conclusions concerning the permeability of the normal skin: The living, uninjured skin of mammals is impermeable for salves with the usual inunction methods. With the usual inunction methods, salves may penetrate to varying depths into the hair follicles.

OBSTETRICS.

UNDER THE CHARGE OF

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Cleidotomy in Labor Delayed by Excessive Size of the Shoulders, the Head Presenting.—In the *Archiv für Gynäkologie*, Band liii., Heft 3, 1897, VON HERFF urges the value of cutting the clavicles of the fœtus in cases where birth is difficult or impossible because of the excessive size of the shoulders. This procedure has been advocated by some in breech labor when it was found impossible to extract the child because of its excessive size. He narrates the following interesting cases in which the head presented and in which cleidotomy was performed.

The first was that of a multipara whose child presented in labor by the face; progress was not made, and the child perished from birth-pressure. An effort was made to apply forceps, but the instrument slipped. The head finally emerged, and showed that the fœtus was anencephalic. As the trunk did not follow, examination revealed the fact that the shoulders were excessively broad, and were transversely above the pelvic brim. The fœtal thorax was also excessive in size. An effort was made to bring down the posterior shoulder, but this failed. A perforator was then introduced along the fœtal back, some of the upper ribs were separated, and one of the clavicles broken; the shoulder at once descended, and the fœtus was delivered without difficulty.

A second case was that of a multipara who had a flat rhachitic pelvis, in whom labor was delayed by disproportion between fœtus and maternal pelvis.

The head was delivered by forceps, but all efforts at traction upon the shoulders failed to cause the child to emerge. The shoulders were impacted above the pelvic brim in the right oblique diameter. It was impossible to dislodge the child or to bring down an arm. Accordingly the clavicle of the posterior shoulder was broken with a perforator, and the shoulder descended. The trunk was then brought deeper by a blunt hook, the arms extracted, and the child delivered. It had perished before extraction, from birth-pressure.

[The editor recalls a case very similar to the latter, in which a fœtus of excessive size was contained in a normal pelvis. The head was extracted by forceps, but the shoulders could not follow. In this case the clavicles were fractured while the operator hooked his fingers into each axilla in succession, and delivered the child by strong traction. Although it was born living, it survived but a few days, dying from the results of birth-pressure. This procedure is virtually embryotomy, and it must be rare for a child to survive a birth so difficult as to render cleidotomy necessary.]

Practical Asepsis and Antisepsis in Obstetrics.—Richard Braun and Hübl, in the *Archiv für Gynäkologie*, Band liii., Heft 3, 1897, contribute a long and interesting paper, giving the methods employed in the obstetric clinic of Gustav Braun at Vienna. While a portion of this paper is purely critical and argumentative, it contains a statement of practical methods and results which is of interest.

In measuring the temperature of the patient, the writers prefer to use the thermometer in the axilla, and they give many good reasons for not measuring temperature in the rectum. They rely in all cases upon thoroughly cleansing the external genitals with 1 per cent. lysol solution, which is applied by douching, and not by rubbing with cotton. A sterile pad of cotton is then placed over the vulva. In judging of the condition of a puerperal patient, they consider the pulse-rate of great importance, and especially the relation existing between the pulse and temperature. Those who deliver patients are obliged to clean the hands thoroughly with soap and brush in hot water for three minutes, then cleaning the nails, and again brushing the hands with soap and water two minutes longer. While still wet, the hands are brushed vigorously in an alcoholic solution of bichloride for three minutes, eight minutes in all being occupied in this process. Patients are delivered lying upon the left side, the hands of the operator being repeatedly immersed in a bichloride solution contained in a basin at the bedside. The perineum is covered with a sterile towel during delivery.

The sanitary surroundings of the clinic are not the best; there is deficient air-space, the building is very old and inconvenient, and there is a lack of many of the modern facilities for securing good hospital hygiene. In view of these facts and the large number of cases treated, the authorities of the clinic do not feel justified in relying simply upon asepsis, but follow also strictly antiseptic precautions.

During the year 1895, 2956 labors occurred in the clinic, and in classifying these the minor obstetrical proceedings, such as rupturing the membranes, pressing the head into the pelvis, replacing a prolapsed fœtal part, and removing retained membranes are reckoned among normal births. In the same

category are a case in which vaginal fixation of the uterus had been performed, and also the case of a girl aged fourteen years and one month, delivered of a good-sized child by spontaneous labor. The material of the clinic was very thoroughly classified and tabulated. From these tables practical deductions may be drawn. In but six cases was version made to secure a better delivery through contracted pelves. Such version is especially avoided in primiparæ, while in multiparæ it is most successful in cases of flat pelves. It naturally follows that the forceps is used not infrequently at the brim of the pelvis. The ground is taken that it is practically impossible before active labor sets in to give a prognosis as to the possibility of spontaneous delivery. In contracted pelves the obstetrician should always await the trial of labor with the head presenting, remembering that craniotomy upon the after-coming head is more difficult than when the head presents. The fatality of rupture of the uterus is well illustrated in the fact that four cases were admitted requiring abdominal section, and each of the patients succumbed. In face and brow presentations the majority terminated spontaneously, and it was remarkable that but little injury to the perineum and pelvic floor happened in these labors.

As regards the care of puerperal patients, vaginal douches of 1 per cent. lysol were given if the lochia became foul, and ergot was also administered. Where the perineum had been sutured and did not unite, the stitches were removed and the surfaces painted with tincture of iodine. Portions of membrane and placenta retained in the uterus were delivered by forceps when they began to emerge through the cervix. Septic mortality and morbidity were much greater from cases examined outside the hospital before admission. The percentage of septic mortality was $\frac{8}{100}$ of 1 per cent. in cases treated in the clinic, while in cases delivered outside the clinic the mortality-rate from sepsis rose to $\frac{56}{100}$ of 1 per cent.

[It is interesting to observe in this large clinic the success of the simple essentials of antisepsis: first, the strict avoidance of all unnecessary manipulation within the vagina; second, cleansing of the external parts by douching rather than by scrubbing; third, the use of a simple but sterile occlusion dressing; and, fourth, the careful antisepticizing of the hands. In this process we note that the hands are carefully scrubbed free from soap, and when wet are scrubbed in bichloride and alcohol. This method of cleansing remains the best available for the purpose. These methods, which gave such good results in a large clinic in which midwives are trained, can be perfectly applied in obstetric hospitals and with private patients. —Ed.]

A Discussion of Hyperemesis Gravidarum.— At the Montreal meeting of the British Medical Association a discussion of this subject elicited much of interest (*British Medical Journal*, 1897, No. 1921). Among others, Giles, of London, had analyzed 300 cases in the London Lying-in Hospital to determine the cause of the ordinary vomiting of pregnancy. He found in 33 per cent. of cases there was no vomiting at all. In 50 per cent. of cases there was no vomiting during the first three months of pregnancy. Among primiparæ there was a close and constant relation between vomiting of pregnancy and previous dysmenorrhœa. Vomiting during the latter months was

frequently associated with amniotic dropsy, twins, or an unusually large child.

As regards the treatment, the bromides were considered of value administered by the rectum or by the mouth. Dilatation of the cervix, either by the finger, by packing with gauze, or by dilators, has proven valuable. All those who discussed the question agreed that delay was too often practised in emptying the uterus, and that no hesitation should be felt in resorting to this procedure so soon as other treatment was not promptly effective.

[As illustrating the fact that the causes which produce dysmenorrhœa may bring about pernicious vomiting, we recall three cases of marked anteflexion of the uterus in which the patients had habitually suffered great distress at menstruation. One of these came to autopsy, when a cyst was found in the cervix; in another premature labor came on, and the cervix could not be dilated without extreme difficulty, while in a third the anteflexion gradually became less and the pregnancy was uninterrupted.—ED.]

Labor Complicated by Abnormalities of the Cervix and Vagina.—In the *British Medical Journal*, 1897, No. 1921, CAMPBELL describes the case of a vigorous young primipara whose labor was ineffectual. A large red swelling protruded from the vagina, and was found to be the cervix, although no os could be detected. Under an anæsthetic a careful search found a red spot on the posterior aspect of the tumor. This was readily scratched through with the finger-nail, the finger swept round the cervix, when rapid dilatation took place, and delivery was effected by forceps. In the case of a multipara a faint ridge in the cervix was the only sign of the os; this was readily entered by the finger, and dilatation promptly followed. In addition, Campbell reported two cases of septa in the vagina, and also the case of a primipara brought to the hospital in labor, in whom the vaginal orifice was smaller and situated further forward than usual. It was supposed that the amniotic liquid was gradually escaping; the head could be felt in the pelvis, covered by a thick membrane. Under an anæsthetic, it was found that the supposed vagina was the dilated urethra. The gradual escape of urine had been mistaken for the passage of the amniotic liquid. When the hymen which had persisted was severed the vagina was found normal, and delivery followed. The patient never entirely regained power of retaining urine.

[To the foregoing may be added those cases of abnormally thickened cervix with adherent fœtal membranes which result from chronic endocervical inflammation, often gonorrhœal in origin. This condition may be suspected when dilatation is extremely slow, the membranes failing to protrude into the os. In the first stages of labor the gauze tampon plays a most useful part in the treatment of these cases. If the end of the gauze be carried through the os and within the cervix, the membranes will be gradually loosened. Elastic dilators are usually incompetent to secure dilatation in these cases, and multiple incision of the cervix, followed by the use of the elastic bags, is indicated.

In a recent case of incomplete abortion at six and one-half months, the editor had occasion to employ gauze packing for two days, followed by multiple incision and dilatation, with delivery of the fœtus piecemeal. The membranes were entirely adherent, as was also the placenta.—ED.]

GYNECOLOGY.

UNDER THE CHARGE OF

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Myomata of the Large Intestine.—PFANNENSTIEL (*Centralblatt für Gynäkologie*, No. 20, 1897), examining a patient who entered the hospital on account of progressive emaciation and complete incontinence of urine, found her pelvis filled by a smooth, hard, firmly adherent tumor, which pushed the uterus and bladder upward. Another similar growth the size of a child's head lay above and to the right of the symphysis. By distending the rectum with gas the first tumor was found to be retro-intestinal.

On opening the abdomen the upper growth was seen to lie behind the descending colon, and was enucleated by splitting the mesentery. It was attached to the posterior surface of the colon by a fleshy pedicle, which was ligated, severed with the Paquelin, and the peritoneum sutured over the stump. The removal of the intra-pelvic growth was attended with great difficulty. An incision was made in the posterior layer of the left broad ligament, the pararectal tissue was divided with the cautery, and the tumor was seized with a volsella and drawn forcibly upward, being enucleated partly with the finger and partly with the cautery. The cavity remaining was drained per vaginam, and the uterus and rectum were sutured together in order to shut it off from the abdominal cavity.

Microscopical examination of the specimens showed that they were pure myomata, with no trace of sarcomatous degeneration. The writer infers that they could only have developed from the mucous membrane of the intestines.

Adenomatoid Growths of the Tubal Mucosa in Tuberculosis.—WOLFF (*Ibid.*), in examining a Fallopian tube with unusually thick walls, found on the mucosa a number of nodules the size of a bean. The macroscopical diagnosis of carcinoma was made, but under the microscope the nodules were found to be cheesy in spots, and contained many giant-cells and tubercle-bacilli. Beside the giant-cells there were glandular pouches lined with cylindrical epithelium, from the walls of which extended epithelial processes. The writer explains this glandular development as due to hypertrophy of the epithelium of the tubal folds, resulting from the inflammatory process attending the development of the tubercles. This harmonizes with the statements of Saenger and Barth, that all neoplasms of the tubal mucosa are papillary in character. Since it is probable that true adenoma cannot develop from the mucosa, since the presence of glands is doubtful, he suggests for the growth described the term "adenomatoid."

Diagnosis of Tubal and Peritoneal Tuberculosis.—BULINS (*Ibid.*) states that "salpingitis isthmica nodosa" is not always of tuberculous origin, as has been asserted, but clinically, in the absence of positive microscopical

evidence, the presence of circumscribed nodules in a tube is to be regarded as proof of a tuberculous rather than of a gonorrhœal origin. The diagnosis would be strengthened by the detection of numerous small, hard nodules in the pelvis (from the size of a pin's head to that of a cherry). The latter are usually situated in the broad ligaments and in the serous covering of the uterus and adnexa, and impart a rough sensation to the examining finger like that of a file; or they may form a chain along the sacro-uterine ligaments and on the postero-lateral walls of the pelvis, more frequently on the right side. These are to be distinguished from secondary carcinomatous and papillomatous growths, as well as from the small herpetiform vesicles which are found on the tubes and in the upper portions of the broad ligaments. The latter are small localized transudates; unlike tubercles, they do not give the sensation of circumscribed nodules.

The Vaginal Route.—Döderlein (*Ibid*), in a paper read before the German Gynecological Congress, takes a conservative position with reference to this subject. While in severe cases of "ascending gonorrhœa" he approves of the French plan to extirpate the uterus with the adnexa, he does not favor the ablation of the comparatively healthy organ simply to allow more room for the removal of the tubes and ovaries, unless the latter form tumors too large to be enucleated otherwise. In general the presence of such non-purulent enlargements constitutes an indication for abdominal section, by which more conservative work can be done. That the recognition of the proper limitations of the vaginal route is difficult he admits. In five cases in which he began the operation per vaginam he was obliged to desist and open the abdomen, while in four others in which he intended to remove the adnexa alone he was compelled to extirpate the uterus on account of uncontrollable hemorrhage.

After a fair comparison of anterior and posterior colpotomy, he prefers the latter as being simpler and attended with less traumatism. He now employs the former incision only in enucleating fibroids from the anterior uterine wall, and reaching cysts in the vesico-uterine pouch.

Having had recurrences after vagino-fixation of the uterus, he is inclined to adopt this method of treating retroflexion only in carefully selected cases.

He does not employ clamps except in total extirpation of the uterus.

Bumm, in opening the discussion, held that the cancerous uterus should be removed per vaginam when it is not too large and the disease has not extended to the glands and parametric tissues. When the latter are extensively involved, any radical operation is out of the question. In non-malignant disease of the uterus requiring extirpation the vaginal route is generally preferable, also in certain forms of fibro-myoma. He thinks that the difficulties attending vaginal section for removal of the adnexa have been underestimated, since it is harder and more dangerous than cœliotomy, there being more risk of sepsis and injury to the bladder and intestine, as well as of hemorrhage. He would remove tumors of the adnexa by the vaginal route only when they are small, appear to be pedunculated, and, above all, are not firmly adherent. Accumulations of pus and blood should be attacked per vaginam only when they bulge into the fornix to a marked extent, otherwise by an extra- or intra-peritoneal incision.

OLSHAUSEN agreed with the speaker that in general the uterus should be removed through the vaginal, the adnexa through the abdominal route.

FEHLING was not disposed to abandon vaginal section, but deprecated its wide application. Cœliotomy was preferable in young subjects in whom conservative operations were to be done, and also in cases in which the diagnosis was not clear. Purulent disease of the adnexa was the chief indication for the vaginal incision. He believed that the use of the clamps simply saved time, but offered no other advantages.

MARTIN agreed with Fehling that the time was not ripe for the decision of this question. He preferred cœliotomy in cases in which the diagnosis was doubtful, and where there was a tumor of considerable size with extensive adhesions. The uterus should be spared after removal of the adnexa wherever this was possible. While there would always be a considerable number of cases in which vaginal section was indicated, there were undeniable dangers. He seldom used the clamps, in fact, would never use them unless the field of operation was clearly exposed to the eye. Closure of the peritoneal cavity was most desirable. His own mortality in 454 cases had been less than 1 per cent.

CHROBAK affirmed that in vaginal section visceral lesions were more apt to be caused and overlooked than in cœliotomy. He would lay down two rules: 1. In operating per vaginam one must always be prepared to open the abdomen; 2. The surgeon should never bind himself to finish the operation by the vaginal route, but should tell the patient that he will do what seems best at the time.

Gonorrhœa of the Bladder.—WERTHEIM (*Zeitschrift für Geb. und Gynäkologie*, Band XXXV., Heft 1) reports a case of gonorrhœa in a child nine years of age, which was followed by acute inflammation of the bladder. A bit of the vesical mucosa, removed per urethram, was examined microscopically and fresh cultures were made. Numbers of gonococci were observed between the epithelial cells, as well as in the lumen of the capillaries ("gonorrhœal thrombo-phlebitis"). The latter occurrence explains the mode of development of gonorrhœal arthritis and endocarditis. In the case reported suppuration of both elbow-joints took place. The patient was cured in four weeks.

LINDHOLM (*Finska Läk. Handbujar; Centralblatt für Gynäkologie*, No. 21, 1897) observed a case of gonorrhœa in a young girl, in the course of which acute vesical symptoms developed. The urine contained gonococci, and by cystoscopy the vesical mucosa was seen to be deeply congested, with superficial loss of tissue. The cystitis was cured by irrigation with warm boric-acid solution and instillations of a 1 per cent solution of nitrate of silver.

Treatment of Gonorrhœa.—BALTZ (*Monatschrift für prakt. Dermatologie; Centralblatt für Gynäkologie*, No. 21, 1897) reports the results of the treatment of gonorrhœa with argonin in 158 cases. The usual strength of the solution was 3 per cent., though one of double this strength was employed in obstinate cases. The writer infers that: 1. Gonococci disappear from the urine in about three weeks under this treatment; 2. Solutions varying in strength from 3 to 7½ per cent. cause no irritation; 3. The cure in cases of acute, hemorrhagic cystitis is prompt.

PIÉRY (*Gaz. hebdom. de Méd. et de Chir.*, No. 56, 1896) speaks highly of the therapeutic action of nascent carbonic acid in gonorrhœal affections of the female genital tract. He employs a mixture consisting of seven parts of bicarbonate of sodium and six parts of tartaric acid. An ounce of this powder is introduced into the vagina through a cylindrical speculum, or in a gauze bag. Tartrate of sodium and carbonic acid result from the combination; the latter has an anæsthetic effect, quickly relieving the local irritation, while the tartaric acid renders the vaginal secretion strongly acid, thus cutting short the period of vitality of the gonococci.

KINES (*Centralblatt für Gynäkologie*, No. 21, 1897) makes a novel suggestion with reference to the treatment of gonorrhœa of connective tissues. He advises permanent irrigation of the affected parts with water at a temperature of 40° C. He also places the patient in a bath of the same degree for twelve hours, the idea being to keep the entire body temperature so high as actually to kill the gonococci, which, he maintains, can be effected without any marked general disturbance.

Acute Intercurrent Enlargement of the Ovaries.—GOTTSCHALK (*Deutsche med. Wochenschrift*, No. 50, 1896) reports the following interesting phenomena noted in four cases after curettement with a sharp instrument for the relief of simple menorrhagia, previous examination having demonstrated the fact that the adnexa were normal. Convalescence was afebrile, and the patients were discharged cured. From one to three weeks later, corresponding to the time of menstruation (which, however, did not appear) the patients were suddenly seized with pain in one ovarian region. Examination showed that the corresponding ovary was considerably enlarged, its fellow being also larger than before, and exceedingly painful to the touch. In one instance it attained the size of an orange. The temperature was never elevated, and under rest and palliative treatment the ovaries soon returned to their normal size. With the next menstruation the phenomenon again occurred, but was less marked, and the enlarged ovaries were longer in regaining their normal size. The writer explains the condition as follows: Congestion and regeneration of the endometrium are the normal accompaniments of menstruation. When the mucosa is absent, as after curettement, there occurs a vicarious hemorrhage into the ruptured Graafian follicle, which is already closed by blood-clot; the sac becomes overdistended, hence the enlargement of the ovary and accompanying pain. Hæmatocele may, of course, result if the pressure becomes great. Similar hemorrhages may occur into unruptured follicles. The practical importance of this condition is evident in connection with the differential diagnosis of early ectopic gestation. The absence of the pulsation usually noted in the ectopic sac is of considerable clinical value.

Nodular Forms of Tubal Disease.—RIESS (*Journal of Experimental Medicine*, vol. ii., No. 4) concludes a paper on this subject as follows: Nodular enlargement of the tube may be due to several different pathological conditions, the exact diagnosis of which can be made only after microscopical examination. Nodules may be congenital or acquired, and of inflammatory or non-inflammatory origin. They may be present at any part of the tube,

and show the characteristic anatomical structure of that part. Epithelial formations develop from the mucosa (salpingitis pseudo-follicularis), from the accessory tubes (intraparietal parasalpinx, hydro-parasalpinx), or from remains of the Wolffian body (adenomyoma). Epithelioid growths spring from the endothelium of the peritoneal covering.

Connective-tissue nodules are the result of a previous interstitial salpingitis.

Localized muscular hypertrophy may be of inflammatory or non-inflammatory origin (adenomyoma). Round-cell accumulations are due to inflammation, either specific (gonorrhœal, tuberculous), or non-specific (disseminated interstitial or purulent salpingitis).

Ectopic gestation causes epithelioid nodules through the production of pseudo-membranes.

PÆDIATRICS.

UNDER THE CHARGE OF

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ASSISTED BY

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Riga's Disease.—FEDE (*Archiv f. Kinderheilkunde*, 1897, Bd. xxxi., S. 351) describes under this name an affection frequent in Italy, two cases of which have been reported in France by Brun and by Dufournier. It appears as a small lenticular tumor, grayish in color, about two centimetres in length and a half centimetre in thickness, developed upon the lower surface and the frænum of the tongue. As it is observed almost exclusively in nurslings that have cut the lower incisors, it has been attributed to irritation of the tongue by these teeth or by the alveolar border of the lower maxilla in infants that have not yet cut them. Clinically, there are three varieties of the affection: 1. The child is in good health, and simple sublingual tumor exists. 2. The tumor, which has existed already for some time, is accompanied by another affection, such as gastro-intestinal disturbance, tuberculosis, etc., so that the infant is cachectic and the tumor increases in size and shows no tendency toward cure. 3. From the beginning the disease is accompanied by grave general disturbance, leading finally to death. Histologically the tumor is a papilloma, formed by hypertrophy and hyperplasia of the mucosa, principally of the papillary layer. If ulceration occur, the surface is infiltrated with small cells separated in places by a fibrillary network of fibrin.

Pre-natal Infection in Diseases of Infancy.—EDWARD P. DAVIS (*Archives of Pediatrics*, September, 1897, p. 641) presents an important study of a class of cases of obscure infection in the first few weeks of life, the characteristic of which is a disorganized state of the blood manifested by

hemorrhages from the bowel, sometimes from the vagina, urethra, nose, mouth, and, in extreme cases, from the skin. Such cases have been variously described under the name of Winckel's disease, hemorrhagic disease of the newborn, hæmoglobinæmia, and other titles. With these, as a class differing from the hemorrhagic cases only in degree and not in kind, the author includes cases seen not infrequently in private practice, which do not go to the point of actual hemorrhage, but in which the newborn child gradually develops green stools, prostration, convulsions, coma, and death.

For preliminary data he examined the blood, milk, and placental tissue of a number of apparently healthy, though as a rule anæmic, mothers in the maternity department of the Jefferson College Hospital, as well as the blood and feces of their infants; and it was found that there was no correspondence between the number of blood-corpuscles or percentage of hæmoglobin in a given mother and the same in her infant. The placentæ of these mothers, examined immediately after delivery, gave negative bacteriological findings, though it has been abundantly proved that the acute infections, like typhoid, tuberculosis, and sepsis, pass through the placenta. It must be accepted, then, that under ordinary conditions the placenta at birth is a sterile substance.

In 57 per cent. of the mothers the milk before the first nursing was sterile; in the remaining 43 per cent. the ordinary pyogenic bacteria were present, namely, the staphylococcus pyogenes albus and aureus, as has been observed by others. Mammary abscess, however, did not develop in any of these women.

The examination of the feces of the infants showed that in over 11 per cent. micro-organisms were present in the meconium before the first nursing; in 33⅓ per cent. after nursing, while the remainder failed to show the presence of intestinal bacteria. The organisms found were the staphylococcus albus in most cases, the s. aureus and minor forms in others, while in one the bacillus coli communis was present. These observations, while not extensive, seem to point to the fact that in the milk of the mother there may be present organisms capable of setting up infection in the infant's intestine with resulting toxæmia. There was no septic condition in any of the mothers or in the attendants of the hospital, and thorough antiseptic precautions were taken with all women before labor.

During the progress of these investigations a number of cases, varying in severity, arose among the infants examined, in which green stools, variations of temperature, hemorrhages, and in two cases a fatal result developed. The mother of one of these children was in good condition, but its feces, passed before nursing, contained the staphylococcus pyogenes albus in pure culture. This child manifested the symptoms described, and died. The autopsy revealed briefly the following: Kidneys swollen, dark, and oozing with blood; the mesenteric and retroperitoneal glands greatly swollen, but not caseous; the liver also; the suprarenal capsules contained clotted blood; the walls of the ventricles were relaxed and contained clotted blood. In this instance it is possible, the author thinks, that the child's disease arose from germs already present in its intestine at birth.

In the second fatal case neither mother nor child showed an abnormal condition of blood at birth; no bacteria were obtained from the milk, nor were

any found in the baby's intestine soon after birth; but the child died after eleven days, with a temperature of 106° F., and multiple hemorrhages from all mucous surfaces. The feces of this infant contained the bacillus coli communis and the micrococcus pyogenes aureus. The mother of this child became uræmic before its birth, and the author is inclined to attribute much of the infant's condition to the mother's deficient excretion.

All infants showing a tendency to green stools, discharge of blood, or hemorrhages from mucous surfaces, were therefore treated by copious intestinal irrigations with normal salt solution; the result, with the exception of the two cases mentioned, was gradual improvement. Although the mother's milk could not be proved in all cases to be at fault, still, unless prompt improvement followed the irrigation, breast-nursing was suspended for a partially digested milk mixture. No other method of treatment seemed of the slightest avail.

The author has isolated from three fatal cases of acute hæmoglobinæmia a germ resembling that associated with yellow fever, which is capable of transmission through pregnant animals to their young.

New Methods of Resuscitating Stillborn and Feeble-born Infants.—BEDFORD BROWN (*Therapeutic Gazette*, 1897, vol. xxi., No. 6) in a timely paper under this heading distinguishes between the stillborn and deadborn thus: In both conditions the vital functions are in a state of absolute suspension—in the deadborn, permanently; in the other, temporarily. Again, in the one the vital functions cannot be resuscitated, while in the other they can be restored. In the stillborn infant the cardiac sounds are absent, and there is entire suspension of the pulse; the muscles are perfectly limp and relaxed; the function of respiration is absolutely suspended; yet the vital spark is retained and capable of being restored to vigorous life. In the feeble-born the cardiac sounds are barely perceptible; the function of respiration amounts to a mere occasional sigh or gasp; the reflex functions of the cord are greatly impaired, and so are sensation and muscular or voluntary action.

The most certain test to distinguish between the stillborn and the deadborn is the temperature. In the former the rectal temperature may be two or three degrees below the normal; in the latter ten or fifteen degrees below normal will be registered. The maintenance of a temperature near normal, then, offers the most significant indication for persistence in efforts at resuscitation. The author has seen infants restored after twenty or more minutes of total suspension of cardiac action and respiration.

Another valuable sign is the state of the pupil. In the dead the pupil is widely dilated, while in the stillborn it is but little, if at all, relaxed.

In the treatment of stillborn and feeble-born infants the author has found that subcutaneous medication is the most efficient and successful method. First, he inserts in each arm, by hypodermic syringe, four or five drops of whiskey and a single drop of tincture of belladonna. The stillborn infant will usually respond quickly and promptly to this stimulation. If there is no response, or a very feeble one, he injects a drachm or two of warm, sterilized water under the skin, and about two drachms with a drop of aromatic spirits of ammonia into the bowel, and then awaits results. The first indication of a response to these hypodermic remedies is soon mani-

fested; the muscles of the eyelids contract, and the eyes, previously closed, suddenly open; the respiratory muscles act, the glottis opens, air is inhaled, and suddenly exhaled with the well-known cry. The heart begins to beat, and pulsation appears at the wrist. In his observation the respiration has always been restored before the action of the heart. In case of marked cyanosis he has found subcutaneous injection of warm water at a temperature of 102° or 103° flushed the skin, aided in oxygenation, stimulated the heart, and increased the temperature. The application of dry heat by means of a well-covered hot-water bag should follow the treatment in all cases. The hypodermics may be repeated according to necessity until deglutition is established, when a drop each of aromatic spirits, tincture of belladonna, and brandy may be given in warm milk or tea until reaction is thoroughly established.

Motor Aphasia at the Beginning of Scarlatina.—Brasch (*Berliner klinische Wochenschrift*, 1897, No. 2, S. 30) reports a case of scarlatina in a girl, aged three and one-half years, in which motor aphasia appeared on the fourth or fifth day of the eruption, thus differing from the usual time of appearance, which is late in the disease, ordinarily about the time of appearance of renal symptoms, and is a symptom of uræmia. In the case reported the speech-disturbance disappeared after fifteen days.

The author has searched the literature, but has found no other case of aphasia at the beginning of scarlatina. The observation shows that the prognosis of aphasia in these cases in children is good.

Poisoning by Bromoform.—Since the introduction of bromoform by Stepp, in 1889, for the treatment of pertussis, not a few cases of poisoning have been reported. Boergner has collected fourteen cases, and recently in discussion (*Der Kinderarzt*, 1897, viii. 49) Lange, of Leipzic, reported a fatal case in an older child who had taken the ordinary dose. Rembe, at the same time, gave the notes of another case, fortunately not fatal, occurring in his own practice. The patient was a boy, aged seven years. Under the use of antipyrin the paroxysms averaged about six daily. He was prevailed upon by the parents to substitute bromoform. Five drops were given three times daily. About a week later the child became unconscious shortly after receiving from six to eight drops given by mistake in addition to the regular evening dose. The boy was comatose, and could not be roused by any form of irritation. The limbs were completely relaxed, and he could not swallow. Respiration and pulse were both normal. Coffee with brandy was ordered, to be given when the patient became able to swallow. By next morning the boy was well, except for slight drowsiness. No paroxysm of whooping had occurred since the extra dose had been administered.

The appearance of the boy when first seen was as one deeply chloroformed, and it is probable that in the system bromoform gives origin to chloroform. The whole dose ingested during the evening probably did not exceed fifteen drops. The case, therefore, offers a warning against any but the most careful administration of the drug.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Etiology of Meningitis.—The study of a case of circumscribed basilar meningitis which resulted from middle-ear disease has led WOLF to review the literature of similar cases, more particularly as regards the etiology of the disease (*Berliner klinische Wochenschrift*, 1897, No. 10).

In Wolf's case the autopsy revealed an old softened thrombus in the right lateral sinus and in one of the veins of the pia mater opening into it. About this was an area of purulent inflammation in both pia and dura mater. There had been chronic median otitis of the right side extending into the right mastoid process. The lungs showed recent catarrhal pneumonia.

Bacteriological examination of the pus from the meningeal lesion showed the presence of the pneumococcus of Fränkel in pure culture. The identity of the germ was confirmed by various culture and staining methods and by animal inoculations.

Search of the literature disclosed records of 174 similar cases in which bacteriological examinations had been made. The results of these examinations showed the meningitis to have been caused by the pneumococcus in 44.23 per cent. of the cases; by the meningococcus intracellularis in 34.48 per cent.; by the staphylococcus in 3.45 per cent.; by the streptococcus in 8.05 per cent.; by the bacillus pneumoniæ Friedländer in 1.13 per cent.; by the bacillus typhosus in 2.87 per cent.; by the bacillus Neumann-Schäffer in 1.72 per cent., and by bacillus coli communis, bacillus pyogenes fœtidus, bacillus aërogenes meningitis, and bacillus mallei in 2.87 per cent. of the cases.

No bacteria were found in 1.15 per cent. of the cases.

It is thus clear that purulent meningitis is not necessarily the result of infection by any one particular species of bacteria, but that a very considerable number of species are capable of acting as its cause. Nevertheless, it is noticeable that the pneumococcus, the meningococcus intracellularis, and the streptococcus together compose the etiological factor in about 86 per cent. of the cases.

On Tyrosin in the Urine.—Some time ago attention was called by ULRICH to the fact that leucin is in small quantity a normal ingredient of the urine. A recent paper by the same author records the results of a large number of observations as to the occurrence of tyrosin in the urine in health and in various conditions of disease.

In his study he proposes a new method for the detection of tyrosin in small quantity. The urine is first evaporated to dryness and is then gently heated, the containing vessel being covered with a glass plate or funnel. The tyrosin sublimates and deposits on the cool glass in its characteristic crystalline form, the crystals also showing the well-known reactions of tyrosin.

Examinations of twenty different urines from normal individuals showed the presence of tyrosin in all of them. It was also found to be constantly present in cases of cirrhosis of the liver, carcinoma of the liver, gallstones, catarrhal jaundice, Weil's disease, nephritis, cystitis, gout, bronchitis, tuberculosis, typhoid fever, glycosuria, hysteria, etc. It was, however, never found in cases of well-marked diabetes.

Since leucin and tyrosin are formed in the normal intestine as a result of the action of the pancreatic juice on proteids, Ulrich attaches much importance to its absence from the urine in cases of diabetes as indicative of disease of the pancreas.—*Nordiskt medicin. Arkiv*, 1896, No. 11. Reported in *Centralblatt für innere Medicin*, 1897, No. 12, 297.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF
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Disinfection by Formaldehyd.—Dr. Hans Aronson (*Zeitschrift für Hygiene*, xxv. p. 168), reviewing the various difficulties to be overcome in disinfection by formaldehyd, mentions the fact that if the strength of the formalin solution exceeds 40 per cent. a polymeride of formaldehyd, the solid paraformaldehyd, is formed and separates, and if one heats the solution further, a solid tenacious mass forms on the bottom of the vessel and finally begins to burn. To avoid this difficulty it was proposed to heat the formalin in solution with methyl alcohol ("holzin"); but this process has been found to be by no means free from disadvantages. Polymerization occurs, large amounts of wood alcohol are evaporated to no purpose, and large volumes of formaldehyd cannot be disengaged in a short time. Next, it was proposed to develop the formaldehyd directly by oxidation of wood alcohol by means of lamps constructed for the purpose. Various lamps were devised and tried, but the results in every case proved to be more or less unsatisfactory. The process proved to be expensive, the yield of active gas was not large, many lamps were needed for even small rooms, and the use of the lamps was not devoid of danger. The next step was to employ an apparatus in which a solution of formaldehyd was heated strongly under pressure of three atmospheres with the addition of calcium chloride to prevent polymerization. This, however, proved defective in several particulars, and in addition was very expensive. Aronson claims to have found a simple safe apparatus which will develop large volumes of gas in a short time from the solid paraformaldehyd in the form of pastilles. It consists of a metallic

cylindrical shell beneath which is an alcohol lamp provided with several wicks. In the upper part of the shell hangs a cup for the pastilles, and in its sides are a number of slits through which the heated products of combustion of the alcohol must pass. The pastilles, which weigh one gramme each, are placed in the cup, the lamp is lighted, and the hot gases of combustion transform the solid polymeride into formaldehyd gas and mix thoroughly with it, and at the same time contribute the necessary amount of moisture to prevent polymerization. The gas is disengaged with great rapidity and diffuses evenly.

The lamp is filled with ordinary alcohol to the extent of twice as many cubic centimetres as there are pastilles in the cup. The wicks must project only slightly, so that the apparatus shall not get too hot. The manipulation of the apparatus is very simple and free from danger. It is best to place the lamp on a metal plate on the floor of the room. All openings in the room are closed, and after leaving it the alcohol is allowed to burn out.

Aronson experimented in a room of 100 cubic metres capacity, in which the test objects were placed at different levels. It made no difference whether they were placed on the floor, half-way up, or near the ceiling, which fact demonstrates the uniform diffusion of the gas, which has a specific gravity about the same as that of air.

The test objects used were staphylococcus, streptococcus, bacillus pyocyaneus, the bacilli of typhoid and diphtheria, anthrax spores, and tubercle bacilli. These were prepared in various ways on gauze, paper, linen, and woollen, in thin and thick layers and in moist and dry conditions.

In the first series of experiments two lamps were used, each with 100 pastilles; that is to say, two grammes of the disinfectant for each cubic metre of air space. The objects were distributed, the lamps lighted, the room closed and left so for twenty-four hours. On opening the room the odor was so strong that a person could stay but a very short time in the room without suffering intense irritation of the eyes and coughing. On opening the windows the smell was soon removed. All the test objects were found to be completely sterilized.

In the second series but one lamp was used with 100 pastilles. All the test objects were completely sterilized within twenty-four hours, with the exception of anthrax spores.

Aronson agrees with Vaillard and Lémoine and others that the penetrating power of the agent is not considerable. Objects wrapped in several layers of filter paper or in thin linen are disinfected, but placed in the middle of feather pillows they are not acted upon sufficiently. All surfaces should be exposed as much as possible For the higher organisms Aronson claims that formaldehyd is non-poisonous. Animals, such as rabbits, left in the rooms during disinfection are not killed, and section fails to show what one would expect, intense inflammation and irritation of the bronchi.

[The conclusions of Aronson as to the action of the agent on animal life are not in accordance with the experience of several practical disinfectors in this country.—ED.]

Cholera and Flies.—SURGEON-CAPTAIN W. J. BUCHANAN (*Indian Medical Gazette*, March, 1897) gives an account of an outbreak of cholera in Burd-

wan jail, which he regards as a case of strong presumptive evidence in favor of the theory that flies may spread disease. Nine cases of cholera, four of which were fatal, occurred in six different sleeping wards. All of those affected had been over a month in jail, excepting the second person to be taken, who had been there but seven days, and another attacked later, who had been there twelve days. There had been no prevalence of diarrhœa before, during, or after the outbreak, and at the time the jail was exceptionally free from bowel complaints. The water-supply was practically above suspicion, and so was the milk. The number of male inmates was 190, of whom ninety belonged to the "infirm gang." There were also about ten women inmates. The water-supply was the same for all persons in the jail. The milk was boiled before use, but none of those attacked were given milk. The "infirm gang" worked and slept in association with the ordinary prisoners, but their food was specially cooked and they were fed in a separate place in the hospital compound. The others were fed and had their food cooked at the extreme opposite corner diagonally from the hospital. None of the "infirm gang," nor the women, nor the hospital patients, nor the attendants, nor the staff of the jail were attacked.

Just outside the jail walls, at the corner where the ordinary prisoners were fed, were a deserted compound and row of dirty huts, where a year ago had been a number of fatal cases of cholera. Outside, at the other end diagonally from where the "infirm gang" were fed, were a jail-tank and garden, both clean. At the time, the city was more than usually troubled with swarms of flies, and just before the outbreak a strong E.N.E. wind was blowing. The theory of the officials is that swarms of flies were blown by this wind from the huts into the jail-yard, where, on reaching the trees and corner of the high jail wall, they obtained shelter from the storm and settled on the food exposed on plates before the gang which fed at this corner. It is certain that all the affected prisoners were fed at this place on the evening of the storm. Supposing the infection to have been brought inside the jail at this time, the periods of incubation were as follows: One of from twenty-four to thirty-six hours; six of from three to four hours; one of six days; one of seven days.

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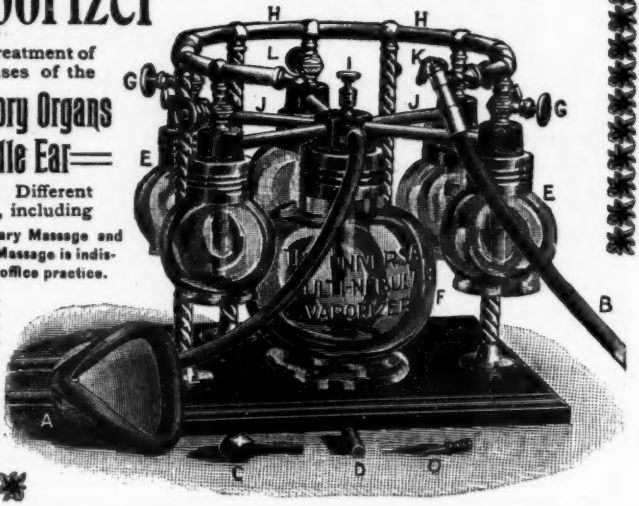

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ANALYSIS AND REPORT OF DR. A. GABRIEL POUCHET

Professor of Pharmacology and Materia Medica of the Faculty of Medicine of Paris. Director of the Laboratory of the Consulting Committee of Public Hygiene of France.

PARIS, February 12, 1897.

"The collections of **disintegrated** or **broken down vesical** or **renal calculi** which forms the subject of the following analysis and researches, were sent me by Doctor Edward Chambers Laird, resident physician **Buffalo Lithia Springs, Virginia,** U. S. A. **They were discharged by different patients after the use of the mineral water of Buffalo Lithia Spring No. 2 for a variable time.**

"I advise here from the experience of Doctor Laird the use of this mineral water, which has had with him a happy influence on the disintegration of the calculi and their elimination. It is to demonstrate this that he has requested me to make this analysis.

"The collections of the **disintegrated calculi** submitted to my examination were eight in number.

SPECIMEN OF CALCULI "A."—These **disintegrated renal calculi** are very numerous, and present themselves in the forms of grains of *various sizes (from that of the size of a pin to that of a pea)* of reddish yellow color, very hard and nucleus in the center. They are thus composed: Urate of ammonia—for the greater part; free uric acid—small quantity; carbonate of ammonia and magnesia—small quantity.

CALCULUS "B."—This **disintegrated vesical calculus** presents itself in the form of **many fragments** of a granular aspect of a greyish white color. *They are easily broken, and the contexture of the fragments show that they are porous throughout.* Chemical composition: Urate of ammonia—for the greater part; carbonate of ammonia and magnesia—in small quantity.

CALCULUS "C."—**Vesical calculus reduced to crystalline powder,** granular, of a greyish white color, rather friable. Chemical composition: Phosphate of ammonia and magnesia—for the greater part. Carbonate of lime—**small quantity. Oxalate** of lime—very small quantity.

CALCULUS "D."—**Vesical calculus thoroughly disintegrated, fragments many** and angular, granular aspect, of a rather fragile consistence of a greyish white color. Chemical composition: Bicalcic phosphate—for the **greater part** (fusible directly to the blow pipe). Oxalate of lime—small quantity. Carbonate of ammonia and magnesia—small quantity. Xanthine—very small quantity.

CALCULUS "E."—**Disintegrated renal calculi, many polyhedral fragments, rounded at the angles,** consistence hard, color yellowish red. These calculi are hard and appear formed of concentric layers. Chemical composition: Uric acid—nearly the whole part. Uric pigment—(acide rosacique.)

(SIGNED) A. GABRIEL POUCHET.

A portion of report omitted for lack of space.

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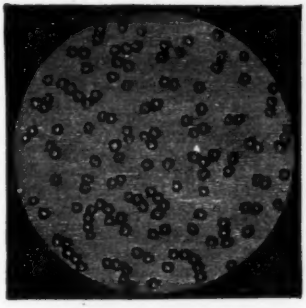

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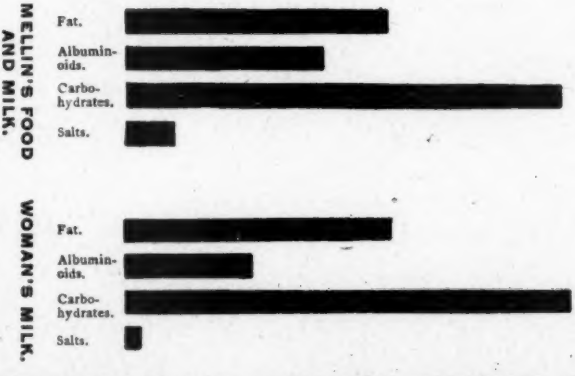
Mellin's Food Prepared with Fresh Cow's Milk as Directed.



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